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VOL. VII. APRIL, 1905. NO. 2.

STATE OF IOWA.

BULLETIN

OF

Iowa State Institutions

A quarterly journal of the scientific and clinical work in the Hospitals for the insane, and in the Institution for the Feeble-Minded, and containing information touching all other Institutions under the care of the Board of Control.

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OF

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(Under the BOARD OF CONTROL)

PUBLISHED QUARTERLY

1905
TELEGRAPH-HERALD PRINTING CO.,
Dubuque, Iowa.

INSTITUTIONS FOR THE BLIND IN THE UNITED STATES ARE AN ESSENTIAL PART OF OUR EDUCATIONAL SYSTEM.

By G. L. Smead, Superintendent Ohio State School for the Blind.

In Ohio, and, I presume in other states, we have to contend against the asylum idea. Our school has been called the "Blind Asylum" from the beginning, and at the present day this name is oftenest upon the lips of the public. This may be partly due to our American tendency to give the shortest name to everything, and then push on to our pleasure or business. We have hardly time to call anything by its full name. We designate thousands of miles of railroad by a few initials. The Ohio State University is O. S. U. A laboratory is a "Lab." A gymnasium is a "Gym." The young ladies in our Co-Educational schools are called "Co-Eds." In one State University the young ladies' waiting room is the "Gab Room." A bicycle is a "Bike." And the sacred name of Christmas is cut short into "Xmas." What wonder than, if in our push and hurry, some should give as short a name as possible to institutions for the education of the Blind and call them asylums with the A sometimes left off. But the use of the term asylum in some sections of our State, at least, signifies an ignorance of the true purpose of our schools for the blind. I have had many contentions with friends of imbecile children for their admission to our school. Even members of the Legislature have urged the admission of such children. A long petition of citizens of one of our counties was once presented to me for the same purpose, and that too after the child had been repeatedly rejected. We have applications from paralytics and epileptics and from those too old to go to school. And, "what are your terms for the admission of patients?" is a question sometimes asked, as though the school was a hospital. The Board of State Charities counts us as proper members of the Association of Charities and Corrections, and we, as officers, are appointed delegates to the State and National Conventions of that body. And in our code of laws we have been classed as benevolent institutions.

As American Institutions for the Blind what are we then? Are we infirmaries, or asylums, or hospitals, or charitable institutions, or are we schools pure and simple? Some years ago we changed the legal title of the Ohio school, from the Ohio Institution for the Education of the Blind to the Ohio State School for the Blind. The Ohio school was founded for the instruction of the Blind, and this change of title was urged by our alumni in protest against even the suggestion, that it is any other than an educational institution. Perhaps there is not much in a name, but there is something in the protest.

The National Educational Association in Boston, a year and a half ago, recognized our schools as belonging to the educational system of the United States by giving a place upon the program to a presentation of our means and methods of education. The educational purpose of our schools is, I think, recognized by all the educators of the blind in the country. The influence of the American Association of Instructors of the Blind is upon this side of the question. By resolution this Association, in convention in Raleigh, N. Carolina, in 1902, expressed the approval of that body, of a real affiliation with the National Educational Association, and that in connection with that Association there be a department of special education.

But how shall we exclude the principle of charity from our schools for the Blind when so many extra things are being done for them? We feed them, clothe them to some extent, and supply means of instruction in literature, music, handicraft, and physical culture. We employ expensive apparatus in these different departments of education. If the educational department of our schools costs fifty dollars per capita, probably twenty dollars is for music, which is an extra in schools for the seeing; and then board and clothing, are not these so much more than the expense of seeing schools? Looking at the question from a civil point of view, not from the sentimental side, what is the object of the State in educating its youth? Good citizenship is the bulwark of the nation. She is strong in proportion to the intelligence and integrity of her citizens; and the state is to so educate her children as to make of them self-reliant, worthy men and women, who shall exalt our homes, and be an honor to our country in peace and in war. The true warrant for a free education is good citizenship. To this end the government through its officers may establish schools, appoint teachers, build school houses, furnish them, select text books, make them free to those unable to buy them, compel attendance, and tax the people for their support. All these things we are doing for our schools for the seeing; and more, we are giving in our State Universities the opportunity or a college education, and for special, technical training, in great part free; and all this that our young men and young women may be fitted for a more advanced and useful citizenship in the application of science to the useful arts. These students thus trained are to be our teachers in the specialties to which they have devoted themselves, whether it be domestic science, agriculture, engineering, mining, or manufacturing. They are to be leaders to train others for useful citizenship. The equipment of our common and high schools, of our State Universities, the large number of students attending them, and the lavishing of money for their support, all witness to the fact that we do not consider this expenditure a charity, but a necessity for the highest development of our citizenship.

But there are a part of our youth who are handicapped by the loss of hearing or of sight. What shall we do for them? Even in a horse race allowance is made for a handicap, not for charity's sake, but to give an equal chance in the race. And may we not in the education of the Blind do somewhat more in the way of help to an education than we do for our more fortunate seeing children, and still not call it charity? Has not a blind man a right to be a good citizen? Is he not under the same obligation to be such, as the seeing man? Shall we not give him a fair chance to enjoy that right, and to meet that responsibility? Are not these added facilities necessary to the best, universal development of our citizenship? Are not we who are more fortunate exalting our own citizenship in helping our weaker brother to be with us a good, responsible citizen of the best country that God has given to man?

But how shall we help our handicapped brother and sister? By supplying as well as we can the means by which his deprivation may be covered and counteracted. By putting into his education such extra facilities as will make up to him in some measure what he lacks. We have our five or six senses given us to meet the conditions of this earthly life. What other special senses might have been given us, or will be given us in a higher state of existence we do not know. Certain it is that there are some qualities of matter, of force and of mind which we have no special sense to perceive. We see as through a glass darkly in respect to many things that attract our curiosity. But with our present senses we know, perhaps, as many of the properties of matter of force, and of mind as we are capable of using.

Each of the senses has its special function. They help each other, but each is confined to its own province. One sense gone, its special function is a blank in the experience of the person so lacking. But the other senses, each acting in its own sphere may make up imperfectly for this want. Sight gone, and all qualities of matter that light gives are gone; color, form and feature, the ink printed page, beauty of pictures, of landscape, of the starry heavens, none of these can minister to the sightless person with their refining influence. Then too, there is the difficulty, in these days of machinery, of following any profitable handicraft for a livelihood, so much depends upon sight in the use of tools and machines.

The sight is the educational sense. The student uses it in all departments of his course from kindergarten to high school and college. The printed page, methods and processes, scientific instruments, all, in our courses of study are adapted to sight. Hence special methods and apparatus adapted to the Blind must be devised and employed in our schools, to meet their peculiar needs.

In all our methods and appliances we must remember that the Blind can not see. A truism, you say; but do we seeing people fully take in the meaning of these common place words? Strangers to the Blind do not always comprehend the physical fact, what are the possibilities of it, and what are the deprivations of the condition. To many, a blind child is a helpless curiosity, and they are surprised that anything can be expected of such a person, and they wonder at the most common place things that the Blind can do, and then fail to understand the physical and mental deprivation under which the Blind labor.

A blind man of my acquaintance was a guest at the home of a stranger. At retiring time his host showed him to the guest room, and, wishing to be very kind and thoughtful, taking him around the room said to him, here is the bed, here is a chair, here is the wash stand, and here is the looking glass. And those who have been familiar with the Blind for many years may not fully take in the statement, the Blind can not see.

The want of sight involves not only physical conditions, but also mental, moral, and spiritual energies. It influences muscle, nerve and brain. It may be a spur to mental and physical action, or more likely, it may have a depressing effect upon all energy. It may influence the sense of personal responsibility to self, to society, and to God. It will effect character for good or evil. And intelligence, independence, and character are essential elements of good citizenship.

Then too there are in some cases evil home influences and conditions which may be the cause of blindness, and the cause too of the most baleful influence of the affliction. If a blind child inherits bad habits and propensities, and also the disease that made him blind, he is doubly afflicted, and the problem of helping him out of his evil condition is a complicated one.

To make good citizens of the worthy and virtuous may not be so difficult, but to do this for the low and vicious may seem a hopeless task, when the inspiration of sight is lacking. Yet we are not to despair even of these. We must lay hold of the good in the heart, if we can find it, and by it raise the soul to a better and purer life. Our blind pupils are with each other in our schools only for a time; then they go out among the seeing with whom they are to spend their lives; hence we must prepare them for the world in which they are to live.

In educating our pupils for society and for the State we should have regard to three lines of training: physical, mental and moral; and these lines of education will act and react upon each other.

In this presence I can not expect to instruct, or to say anything new. I can only express some thoughts that have been upon my mind, not so much for your edification as for the public which you represent.

I will not go over the whole curriculum of our schools, but will touch only upon some special matters that are of importance in our work, in order to justify the claim that our schools for the Blind are educational institutions.

Physical training is necessary to the highest efficiency in all education for the seeing, much more for the blind. Blind children are apt to form habits of sitting, standing and moving that need correcting; and with many of them there is an indisposition to exertion for lack of motive to overcome the difficulties incident to blindness. Hence they need special training to correct unsightly habits, and to arouse to activity.

Physical training will have two forms, manual training and gymnastics. Manual training has for its object instruction and practice in the use of tools. Gymnastics is concerned with correct posture and motion, with energetic exercise for the development of muscle.

Physical training has to do with health and strength of body, with the efficient use of all its powers and their application to useful purposes.

Physical thaining has also in it discipline of mind. It gives alertness and quickness to the power of attention. It trains the will to prompt action, and fosters the voluntary putting forth of effort, so necessary to any success in life. In short physical training ought to have this ultimate result, the unifying of body and mind, with the body the efficient servant of the mind. This is especially needful for the blind; for sometimes it seems that their bodies and minds lacked harmony of action, as though they did not belong to each other. Physical training for the Blind is important because it tends to correct improper physical habits, and to arouse them from the inertia so characteristic of many blind persons.

2. Mental Training. This is the main object of all education. We might say that education has three objects; first to know something, second to do something, third to have the disposition to do something; and that something may be physical, mental, or moral. The principles of education are the same for the Blind as for the seeing, but the methods in some particulars are different.

Language training should receive special attention in the education of the Blind. The power of expression is a source of pleasure and profit to the Blind. The communication of thought by speech takes the place in some measure of sight. If the educated blind man can not see the form and features of his friend, he can by exchanging thought in conversation enjoy the more interesting, inner life of his friend, and he calls this seeing his friend. Much of the enjoyment of life is in the intelligent conversation of congenial minds, and the Blind are not shut out from this means of happiness.

Then too there is the expression of thought in written language, and in public speech. Instruction in correct speaking and writing should be a specialty in our education. Equal in importance to the power of expression in good language is the ability to readily understand what is written or spoken, to grasp the spoken thought quickly and retain it permanently. The multiplication of text books in raised print of late years is a valuable addition to our means of education. They relieve the teacher of some work and add to his efficiency. But it would be a mistake to depend too much upon the raised printed page. Such is the expense of raised printing, that we find it difficult to keep up with the times in our text books, and our pupils will not get the best results if depending upon books alone. Also we grade our scholars according to scholarship and not according to ability to read raised print; especially in our higher grades there will be a great difference in this respect. Hence oral instruction should have a prominent place in our schools. Such teaching gives to the blind pupil the needed stimulus and training for acquiring knowledge. The enthusiastic teacher can impart his own enthusiasm to his class by the spoken description, by holding up before the students in all their meanings and bearings the principles and rules of the science which he is teaching. So much must be imparted by oral instruction in the literary department, in music, and in teaching handicraft, that it is of the utmost importance that our pupils from the beginning and progressively be trained to seize at once upon the spoken thought. Much of the pleasure and profit in after life will come to our pupils from being good listeners. Upon this ability will depend the pleasure and profit which they will derive from music, conversation, sermons, lectures, and speeches, in after life.

Usually the most influential citizens are those who can talk and listen well in private and in public. Political influence consists very much in the exchange of thought between man and man. Good moral influence is exerted in the same way. Our blind men and women are not deprived of this privilege of good citizenship by their affliction, provided they are prepared for it by training and intelligence. Every available means should be employed to secure the correct use of language and the ready and efficient attention to what is spoken. Oral reading, oral instruction in the class room for the power of attention; and topical recitation, written composition, and public speaking for the power of expression, all will be useful for the purpose proposed. While oral reading is very valuable for our pupils it should not be overdone. Too much inattentive listening will defeat the object which we have in view. It is well for the scholar to practice out of class the slower, more thoughtful reading of raised print books, of which we have now such a great variety. It has been suggested that in our schools we read too much orally and do not enough throw the pupils upon their own resources in reading for themselves. It may be so to some extent. Excessive reading to the pupils may dissipate the power of attention instead of increasing it. There is reason in all things. A just balance of means and methods will conduce to the highest efficiency.

With the study of the English language there should be with the advanced pupils the study of some other language; either Latin from which so many of our words are derived, and the study of whose structure is such a valuable discipline, or some modern language or both, if possible, as the German or French for their practical value, and for the training they give in the thinking of other peoples.

All the studies of the school curriculum are as valuable for the Blind as for the seeing, but each may have its peculiar adaptation to the Blind. The study of geography, for instance, appeals to the blind child in his isolation and fixedness of place to lead him out into a comprehension of a larger place than his little, narrow, contracted world. The study of history is a pleasure to the bright, blind student. In this study he comes to realize that there are other people in the world besides himself and his immediate friends, an idea that does not always penetrate the mind of the blind child till he meets some of the rough knocks of life in school and out of school.

The study of the sciences by the Blind presents some difficulties, inasmuch as the processes and apparatus appeal to the sight. Yet the relief models of physiology, working models of machinery, and machines themselves are tangible, and will give some valuable idea of the forces of nature as applied to machinery.

A former pupil of ours went to the St. Louis Exposition. He said that on his first visit all was confusion to him. But a friend made for him a model of the grounds and the position of the buildings. Then the general effect of the Exposition was clear to him. He could not fill in all the details, but so much of the great exhibition was a great pleasure. Now this man was prepared for this enjoyment by long experience and study, as a blind man, in school and out. He had trained himself to look outside of himself into the world around him. At one time he gave in our school a very acceptable lecture upon the subject, "Birds."

The study of mathematics is a difficult one to the average blind student because so much depends upon mental operations, and so little help can be obtained from written calculations. Yet the science is valuable to the blind inasmuch as it leads them out from mere memorizing into independent thought.

Mental science, moral science, and logic, for the more advanced pupils will give opportunity for introspection, counteracted by the application of thought and mind to practical duty and obligation, and also to the orderly arrangement of mental processes leading to right conclusions from the conditions and circumstances which may enter into their experience.

I would bespeak for our blind pupils as varied and extensive a training as time and ability will admit, that they may be prepared for emergencies that may come to them in after life. We never know to what use we may put our knowledge and ability till some necessity obliges us to exert ourselves according to what we know and can do. Scholars in our schools ask the old, old question, "of what use will this study or that study be to me?" To some it seems a waste of time and effort to pursue a study which has no immediate prospect of a money remuneration, forgetting that it is not altogether knowledge that is at a premium in the world. It is not primarily how much do you know, but what can you do? Knowing and doing should go together, but knowing without doing has little market value in the world.

It is difficult to find remunerative employment for the Blind, so few avenues are open to them, and we can teach so few handicrafts and professions in our institutions. But can not some of the Blind, if trained to think and to reach out by effort into the world around them find some special, unusual means of livelihood, and engage in some business or profession which we can not teach in our schools, but which their quickened apprehension finds adapted to their own special ability?

3. Musical Education. Music is the specialty of the Blind. To it they look for a livelihood, either as teachers or performers, or to its allied industry, piano tuning and repairing. But the "Divine Art" should be considered more than a mere commercial commodity. One of the greatest deprivations of the Blind is the lack of appreciation of beauty as it appeals to the eye. The beauty of form and feature, of painting and sculpture, of landscape with its ennobling grandeur of hills and valleys, of mountains which pierce the skies, of the broad expanse of plain and hill and dale as seen from some lofty peak, of the starry heavens, God's marvelous wonders, of the moon shining upon the glistening snow of winter; all these are lost to the person blind from birth.

Music is the fine art of the Blind, the substitute for all that the eye can perceive of beauty; and as a substitute it ought to call out the more refined sentiments of the soul. This higher development of mind is specially needed by the Blind to call them out of themselves into the more lofty realm of unselfish feeling and thought up to an enjoyment not found in the lower application of the art to mere commercial value.

We know that many will fail of this higher attainment even though creditable performers upon instruments. But many, multitudes of seeing people, fail to perceive the beauty of art as it appeals to sight, fail of the uplifting power of painting and sculpture and architecture, and of the beauties of nature; no wonder then, if some of our musicians fail of receiving the full, refining, exalting influence of their art. Yet it is worth while always to train for the highest even for the sake of the few that reach it. There is no loss in the expression of aspiration for the highest and noblest in thought and feeling and purpose. Music in its supreme result is the expression of the loftiest sentiments of the soul, and has in it the reaching up toward that which is heavenly and divine.

Let music be cultivated in our schools, not as a mere commercial expedient, but as the "Divine Art" to enhance the happiness and blessedness of those deprived of other perception of beauty.

The good citizen is the man of integrity and refinement who can by precept and example appeal to the higher sentiments of his fellow men and influence them to the best development of character.

In all this training of body in posture and motion and work, of the mind in literature and science and art, there should always be the upward look toward a higher moral life. Polite manners, agreeable habits, and pure morals are essential to the most influential citizenship. To mingle affably with their fellowmen, to command their respect, as worthy men and women, is necessary to success in any employment or profession in which the Blind may engage. And the influence they will exert as citizens will depend upon character. The whole man is concentrated in character. Complete happiness and blessedness consist in good character. Let us then, as educators of the Blind use all our studies, all our means and methods, all our personal influence, to secure for our pupils this great, essential requisite of good citizenship.

Do not our institutions for the Blind have enough to do as schools pure and simple without attempting to do what is outside of their sphere? As schools are we not bound by our civil obligations to give to all the youth of our land, seeing and deaf and blind a "square deal?"

THE ADULTERATION OF FOOD AND MEDICINE.

By Hamilton P. Duffield, M. D., Surgeon Iowa Soldiers' Home.

The Mosaic Code, given thirteen hundred years before the Christian era, has been the precedent and pattern of all sanitary laws made in the interim between that time and this; and as the lime light of the twentieth century civilization falls upon it, it is seen to transcend all others, in restricting acts, that are not for man's physical well being. Moses claim that these laws were inspired by Jehovah, and that penalty followed their violation, has been verified for hundreds of years, while man made laws, and abuses without laws, have kept step in the march of civilization.

The Jews' care in the slaughter of animals and fowls is proverbial, and the Gentile is fortunate who can be his customer. The Justinian law, enacted through the influence of pious Jews in the sixth century, had sanitary as well as moral regulations.

The mental and physical health of the people is a necessary element in the success and stability of a nation, and as the mental health is so dependent on the bodily health we find of late the needs of the physical man, making a paramount issue in government legislation. The first pure food law was perhaps enacted in Spain in 1283, and was against adulteration of food and delicacies, the sale of poisons, and love potions, infection of the air by putrefying animal matters and so forth. In 1487, and also ten years later, ordinances were promulgated in Germany against the "improvement" of wine, by sugar of lead, in later times beer was in a way supervised, although mainly under control of the guilds. Medical ordinances in cities are spoken of, one in Nuremburg in 1518 regarding the sale of food, and adulteration of wine; the latter seems from very ancient times to have been doctored.

The law of compensation observed in nature we also find operative in national crises.

The existing law against importing adulterated drugs, passed in 1848, was enacted after an investigation of gross frauds in worthless drugs, which the surgeons claimed were ineffectual to cope with diseases brought on by the Mexican climate, and thus hundreds were sacrificed to foreign greed aided and abetted by guilty importers. The "strenuous" individual, whose fearless statements started the "embalmed beef" investigation, did as much toward saving the lives and health of his fellow countrymen, by the agitation then begun, as an army of physicians. The publicity given the canners' frauds, led to the arousal of a sentiment that will eventually crystalize, in a national pure food law, that will enable rigid state laws to be made effective through control of interstate commerce. This resulted primarily from the Spanish-American War, whose cost in life and health will thus be compensated, by the saving of the same to posterity, if it does not benefit all our contemporaries.

Through agitation, consequent upon the loss of life from disease of our army in Mexico during the Mexican War, a committee of physicians was appointed to investigate abuses in the drug importation from foreign countries.

The difference in dosage of certain drugs was investigated, sometimes fifteen or twenty times as large a dose was given in the western and southern states as in eastern localities.

The result brought out the fact that there were pure drugs for eastern physicians, and inferior adulterated and sometimes, worthless drugs, sent for the western and southern states, and to sell by contract to the army.

Europe at that time had stringent laws regulating the sale, and dispensing of drugs, so the United States was a convenient, and profitable dumping ground, for these inferior goods.

The College of Pharmacy of New York had for years protested against misnamed, and sophisticated chemical preparations as imported, as being detrimental to the custom house, and to the health of the people.

The Philadelphia College of Pharmacy was founded for the purpose of exposing these frauds.

Seven hundred pounds of rhubarb, practically worthless, passed the custom house invoiced at five cents per pound, while East India costs forty-five, and Russian two dollars and fifty cents per pound.

Dr. J. M. Bailey was made examiner of drugs, at the port of New York in 1846, and he testified before the committee, that more than one and a half million dollars' worth of drugs passed through that custom house annually, and more than one-half were adulterated or deteriorated.

Accepted contracts made by the "Bureau of Medicine and Surgery," were taken to show evidence of adulteration and fraud, and to demonstrate the need of legislation. Peruvian bark, not powdered, contract price per pound fifty cents, market price seventy cents. Peruvian bark in powder per pound, price twenty-five cents, market price seventy-five cents. Eleterium, contract price per pound one dollar, market price, three dollars and fifty cents. Rhubarb, pulverized, contract price per pound seventy-five cents, market price, one dollar and twenty-five cents. A few more were added and given only as samples of the accepted contracts.

The report of the Committee led to the enactment of the law without debate.

The following argument is quoted from the report of the Committee: "The laws punish the use of the dagger, yet nothing protects the community from violence not less fatal, but better concealed under the popular name of 'trade.'. If a man write another's name, or pass a counterfeit bill, the prison is his doom; if he stop the mail on the highway, and thereby endanger life, he may be executed." To pass a counterfeit bill is a crime, but to pass a counterfeit medicine is not. Trade and correspondence are more valuable than life, because especial laws are passed for their protection. To state the argument is to refute it. Destitution and want may drive a man to seize upon that which is his neighbor's, and we might in pity overlook the crime, or cover it with the mantle of charity; but the cold-blooded, deliberate, studied, and fatal deception practiced in articles designed for the relief of suffering, and disease, can admit of no paliaation—can find no excuse."

The investigation resulting from the Spanish-American War crystalized public sentiment, and pure food laws were enacted in several states, some mildly restrictive, but others, as in Indiana, Washington, Illinois, California, and South Dakota, of real efficiency.

Without doubt the universal press agitation, met the general demand for it, and was the controlling force that induced the Senate in 1899 to appoint a committee to investigate food products, as for fifteen years food bills have been up for passage in the Senate.

In April, 1904, in a speech on the bill pending Mr. Heyburn said: "Although twenty-one, or twenty-two, pure food bills have been before the Senate, this is the first time, any one of these measures has been discussed on the floor of the Senate, under any circumstances." (As-the Senate really passed a bill which originated with the "Grange" and which did not pass the house it must have passed without discussion.)

The Senate investigation Committee was appointed after the adoption of the following resolution: "Whereas it has been for years publicly charged that in the manufacture of articles of food and drink many manufacturers of the United States who transport their goods from one state to another, do most grossly adulterate such products to the serious detriment of the public health and to the defrauding of purchasers: Therefore, Resolved, That the Committee on Manufactures of the Senate is hereby authorized and directed to investigate and ascertain what, if any, manufacturers are adulterating food and drink products, and which, if any, of said products are frauds upon the purchasers."

Senator Mason of Illinois was Chairman of this Committee. Several food manufacturers and chemists of national fame testified before this Committee in different cities of the United States.

The most important evidence was given by Dr. Wiley, who for many years has been chief chemist of the Agricultural Department of the United States. He said that nearly every kind of food in the market had been at some time adulterated, or mis-branded, rendering it either harmful or fraudulent. It was said that Davenport, Iowa, and other localities where maples did not grow, made "Vermont Maple" syrup, made it too of cheap yellow sugar and vegetable extracts, sometimes extract of hickory bark. Dr. Wiley testified that he "had had occasion to make a careful examination of almost every variety of food, that had ever been upon our markets for sale, also drinks, because you include in foods all the beverages and condiments which are used."

He found adulterated milk the commonest fraud, and that Boric acid and Formaldehyde were used in milk as preservatives.

In butter mixtures, cotton seed oil and beef fat, and some times pork fat, all sold for pure butter; this before the oleomargarine act compelling proper labeling of such packages. Said that more than half the strained honey on the market was adulterated—jars of glucose, on which floated pieces of honeycomb.

This Senate Committee said that in their investigation, they felt that many times they had not been able to get at the exact truth; said they owed much to the services of Dr. Wiley, for his marked ability, and unselfish enthusiasm, and "if people could see the horrible stuff sold to the poor, who must buy in the cheapest markets, the poisons that go into cheap soda water, the cheap poisonous stuffs sold for fruit-jams, and jellies, in poor quarters, the thousands of frauds, practiced in the sale of foods upon the ignorant, poor, and sick, and upon the children of the country," the committee felt that all honest people would share Dr. Wiley's enthusiasm.

Notwithstanding the fact that most condensed milk from the large factories of our country is pure, and wholesome, made under good sanitary conditions; these factories to protect themselves from dishonest competition, have to spend much time and money fighting an unwholesome product.

The sugar of the country at present is generally pure, but it would be safer to have a law holding the trust to the present standard.

In syrups the Committee found four grades branded "Maple Syrup," containing from twenty to eighty per cent of glucose. In extracts they found great frauds, and noted that only one manufacturer, (which the evidence shows was Dr. Price of Chicago), invited them to go through his factory from top to bottom—this visit and subsequent analysis, showed that he had nothing to conceal. In examining baking powder, it was the avowed purpose, to determine whether the fruit acid from the grape, Cream of Tartar, or the mineral acid from Alum, was least harmful. While not broadly stated as the result of the report, the investigation, and analysis, showed the purity of both the Royal, and Price's baking powders, and that they were made by the use of pure Cream of Tartar and Soda; the Committee recommended that the use of Alum in baking powders be prohibited by law.

The Committee visited ninety-two breweries and bought four hundred samples. They found salicylic acid most often in imported beers, and American beers for export. They found candy much adulterated and colored with analine dyes, sometimes with terra alba and glucose constituents. Carbonated still wine sold for champagne. Peanut and cocoa nut shells in spices, it was found, made the ground spices cheaper than the whole, as the mixture paid for the grinding, and left a handsome profit.

The evidence of the Government Chemist showed almost every sample of Cream of Tartar purchased either at the drug, or grocery stores, were fraudulent, only one, having a trace of it. This stuff is known by the Cebalistic letters C. T. S. which to the initiated means Cream of Tartar Substitute, this substitute is Alum, and many housekeepers to be on the safe side make their own baking powder, with this fraudulent Cream of Tartar and common soda. The sale of the dried and imperfect berries of coffee (which do not have the taste of coffee) is prohibited in Germany, so they are screened, and sent to America by the ton, as "black jack," and we have this thrice imported coffee in our breakfast beverage, with sufficient chicory to enrich it.

Dr. Wiley found lard was adulterated with vegetable oils, or fats, under the name of refined lard, cotton seed oil used as an ingredient. Concerning olive oil, he states that hundreds of barrels of cotton seed oil go to France and Italy yearly, for the purpose of being refined, and that it is returned to us as olive oil, containing only a mixture of olive oil. His evidence showed that ground mustard was chiefly flour and turmeric for coloring. Coffee, ground and unground, roasted and unroasted, was found adulterated with various substances. Molasses and flour is moulded and colored; to suit the purpose of mixing with green, or roasted berries, sometimes twenty-five per cent of artificial berries are found per pound. He said that ground coffee, was often two-thirds chicory. Coffee selling at forty cents per pound and chicory at about eight cents. Said that "fillers" were manufactured in large quantities, and in colors suitable for mixing with pepper, cinnamon, and allspice, etc.: "these fillers were ground shells of nuts, or colored flour, and a filler for cream of tartar consisted of infusorial earth.

In the making of beer, instead of malt, barley, glucose, rice, and hominy grits were used, generally, because they were cheaper. Some malt was used, but sometimes sixty or seventy per cent. of other things were substituted.

At glucose factories there is an oil extracted from the germ of the grain, that is cheaper than linseed oil, and largely used as an adulterant of that oil. Cider, alcohol, and malt, vinegars all sold for pure cider vinegar. In the investigation conducted by the aforesaid committee, adulterations were revealed that came under two classes: those simply fraudulent, and those fraudulent and deleterious to health.

Dr. Wiley, Professor Mitchell, of Wisconsin, and others testified that butter was sold, from which milk fats had been substracted, and vegetable, and animal fats, substituted. Some testimany was given, as to milk and butter being preserved by "Freezene," (a solution of formaldehyde).

From the Outlook, June 16, 1900, we glean some of the thoughts that follow. Under the class rated as simply fraudulent, we find oleomargarine, sold as butter, honey, adulterated with glucose, exhausted tea leaves, with willow leaf mixture, strawberry jam, made of glucose and timothy seed, buckwheat flour, made of rye and other cheap cereals, currant jelly, made of apple cores and parings, mustard seventy per cent. starch, colored with turmeric.

Pennsylvania statistics issued in May, 1900, showed that eighty-seven millions, eight hundred thousand pounds of olemargarine, was sold in a year, in the United States. It costs seven cents per pound to make, and thirty-three states prohibited by law its sale as butter. but the Outlook said it was sold as butter, at butter prices, thus robbing the people of several million dollars. The oleamargarine, not being deleterious, should furnish the poor a good substitute for butter, at the poor man's price. (H. B. Mason Urgent Need of Pure Food Reform).

Victor Vaughn, of the University of Michigan, in Popular Science Monthly, 1899, says: that the "jellies of commerce are made of apples, boiled with a preparation of tartarine, consisting of either dilute hydrochloric or sulphuric acid, then flavored."

John Bennett, Dairy and Food Commissioner of Michigan, calculated that food adulteration reached fifteen per cent. of that sold in the United States. Vaughn, to be conservative, places it at ten per cent. As the annual food supply amounts to four billions, five hundred million dollars, we pay four hundred and fifty million dollars for fraudulent products.

As a result of the enforcement of Michigan's excellent pure food laws, Inspector Bennett says, there has been at least seventy-five per cent. improvement: and that more than sixteen million dollars is annually saved at an expense of only twenty-thousand dollars per year. Vaughn says, "when the flesh of diseased animals and substances, which have undergone putrefactive decomposition, can be doctored up, and preserved by the additions of such agents as formaldehyde, it is time to demand restrictive measures."

Many analyses have been made in recent years, and some of the published results are satisfactory, others tend to make us doubt our dealers: as when eleven out of forty-five samples of coffee are impure, forty-six out of forty-nine jams, when out of five hundred and seventy-four samples, forty-one and a half per cent. are adulterated.

Judas betrays his Lord at the communion table, even now, when for the unfermented wine, he gives a weak solution of salicylic acid, flavored with grape juice.

In our country, flour, butter, and cheese, are the products protected by Government, and it is only a short time, since there were more than eleven states, having effective food laws, a few more had some statutes not well enforced.

That human greed needs the check of the law, is evident, but Iowa, has not yet lost commercial faith: eating, drinking, and prescribing, whatever comes into her borders, from states already self-convicted.

The Iowa law provides for the enforcement of the dairy laws, by a dairy commissioner and his assistants. The food law, makes it the duty of the State Board of Health, to make complaints to the State's Attorney, for violation of the same. A recent letter of inquiry to the Secretary of the State Board, asking what had been done toward enforcing the law, elicited the following reply, "our Board has done nothing whatever in regard to food and drug adulteration".

The law needs to be bolstered by appropriations, to make it effective, and this our solons fail to do.

Dr. Wiley, in Leslie's Weekly, writing on the action of preservatives, says: "that while as poisons in food, they are not powerful enough to produce death, they act on the organs of the body, gradually reducing their vitality, and finally, endangering the health of the subject". Dr. Carl Kleineberger, of Germany, found, that even small doses of salicylates, gave rise to the urinary phenomena of nephritis, and also desquamative catarrh of the entire urinary tract. A long continued course of treatment for rheumatic trouble with salicylic acid, or salicylate of soda, will convince any observant physician, that it impairs digestion, and causes derangement of the kidney unless quite an interim is given, between periods of dosage, for the stomach and kidneys, to resume their normal function: showing, that daily rations of salicylic acid, are not desirable.

The use of preservatives, have reasonable advocates among physicians and chemists.

Victor Vaughn advocates the use of borax, in such quantities as specified by the English Commission: as the dusting of the surface of the hams, and bacon, to be transported long distances with one and one-half per cent. of the weight of the meat, with borax, or boric acid; as meat thus dusted does not become slimy. Much of this can be obliterated from solid food, by washing and soaking in clear water, and gives the minimum of evil, when contrasted with the danger of putrefaction. Where people are limited to long distance supplies, preservatives are admissible, but in most instances, they are inexcusable, and rest under the ban of suspicion.

The New Hampshire State Board of Health, made a crusade against the use of boric acid, in tubs of oysters: its liberal use, enabled the grocer to keep these bivalves on his counter, in warm weather, without ice. When dealers informed wholesalers, that they were not allowed to sell oysters so treated, the practice was abandoned, without any of them, going out of the oyster trade.

Of all the fraudulent adulterations of drugs, the patent medicine, ranks first. Edward Bok, did more for suffering humanity through his expose of patent medicine frauds, in the Ladies' Home Journal, than physicians can, through medical journals, for the people using the nostrums, are reached by Bok's journal. By giving the analyses of thirty-six medicines, showing their percent of alcohol, he know doubt, shocked many good temperance women, addicted to their use.

Harpers Weekly says: "the patent medicine is strongly intrenched in the affections of the newspaper." One paper owns to an income of forty thousand dollars per annum from this source. Many foreign countries control and regulate the sale of these medicines. Germany has passed strict laws, but has not yet entire control of the sale. Sweden controls by regulating the number of druggists, as there are only three hundred and fifty in the country. In Stockholm there is one druggist to fifteen thousand people, so that there is no need for the patent side, in the apothecary shop.

The law in Ohio fixes the standard, for most foods, and medicines: the enforcement of the law, by convictions, and fines of violators, has given adulterators of the life and health giving forces, a needed lesson.

From 1897 to 1903, inclusive, nine thousand one hundred and seventeen samples of foods, drugs, and beverages, were analysed: of which five thousand six hundred and three were pure, and three thousand four hundred and seventy-four were adulterated.

At least seventy-five per cent. of all the food stuffs imported, come through the port of New York. Enabled, by a government appropriation to prosecute the work, the Department of Agriculture, a few years ago, began a crusade against fraud in imported foods, and drugs. They found, that about one-half of the importations, were adulterated, in some form. By some it is claimed that at the present time, it is reduced to about five per cent. Cheap wines, from one section, were labeled as coming from other vintages, whose brand had a higher commercial value.

The Government can remove these labels, but they can be replaced, after entering into the American trade, unless, another strong hand intervenes, between middle-men and consumer. This is true of most other imports, but it is a great step to have the pure article landed at the seaboard: else Iowa physicians irrespective of schools might be homeopathetic dosers, administering medicine in high potencies.

In January, 1902, Dr. Ernest Lederle, was appointed Commissioner of Health, under Mayor Seth Low. The Health department, kept pace with others, during this reform administration.

The total amount of injurious food, condemned in 1892, was twelve million 293 thousand seven hundred and sixty-one pounds. Nineteen thousand one hundred and eighteen dollars was collected in fines for violations of the Sanitary code, as against six thousand two hundred and ninety-two dollars, the previous year, and fifty-two per cent. of the milk was found adulterated.

Of three hundred and fifteen samples of one drug, phenacetin, only fifty-eight were pure. It was principly adulterated, with acetanilid, worth only one-fourth as much. As the remedy is often taken without a physician's prescription, no heart depressant should be used as an admixture.

In 1904 in New York City, out of eight hundred and seventy-one samples of drugs, three hundred and ten were either impure, or substitutes: throughout the state, nine hundred and seventy-six drug samples were taken, and analysis showed four hundred and fifteen below the standard.

Pennsylvania has been active in the enforcement of her pure food law with results comparable to those reached elsewhere.

While the astute Yankee no longer has recourse to wooden nutmeg frauds, his fellow countrymen, in all sections, have found more scientific, fraudulent, and vastly more lucrative occupations.

The New Hampshire State Board of Health, has published a bulletin, giving analysis of fifteen brands of "Diabetes Flour", purporting to be made of gluten. The Bulletin shows, there is no pure gluten flour to be had: and the exorbitant price charged was about the only thing, in which it differed from common flour.

Most of the vanilla extract now sold is said to be made from coal tar. At the St. Louis Fair, in the Agricultural Building, might have been seen exhibits of the state food and dairy commission, of Minnesota, and those of the Massachusetts' Board of Health, showing the use of aniline dyes, as used in foods and beverages. A handsome collection of cloths were exhibited, which had been colored with soda fountain syrups, tomato catsup, and other foods.

These poisonous dyes, are another reprehensible feature of adulteration.

In a milk crusade in Pennsylvania in 1903 only one town, Milton, failed to reveal a violation of the dairy laws.

The New Jersey report of the chemical department, in 1903, showed forty and eight-tenths per cent. of food adulteration, seventy per cent. of drugs, twenty-nine and one-tenth per cent. miscellaneous.

The Agricultural station of New Haven, published its report for 1902, from which is gleaned the following. Of ninety-four samples of catsup, eighty-four per cent. were colored with coal tar dyes, and had chemical preservatives. Only one-fourth of the vanilla was pure. One-eighth of the lemon extract, nineteen per cent. of jellies and jams.

In 1903 in Masachusetts, from an analysis of over six thousand samples of milk, twenty-eight per cent. were adulterated; other food articles had eighteen per cent. of impurities. In 1902 a pure food crusade was inaugurated, by swearing out warrants against the Kansas City Beef Company, and others, the result of an analysis of canned meats, showing sulphurous acid, and boric acid.

About eighty per cent of all the whiskey sold in the United States is compounded, and while the chemist may not detect the difference in it, and that ripened in the natural way, the stomach is a sure detective, and does not tolerate the fraud without protest. Fifteen year old whiskey, can be made in eighty minutes, by this way of compounding. Brandy is made in the same way, and many wines are innocent of grape juice. The law should compel proper labeling of all liquors.

Many manufacturers are putting on the market, goods of prime quality, while others, sacrifice everything for greed of gain. One of the most dangerous adulterants, is wood alcohol, and unless you know the manufacturer, a test would be a safe precaution: as it enters largely into all liquid medicines, containing alcohol made by dishonest firms: such as essence of ginger, lemon, peppermint, witchhazel, and bay run. At the instance of the American Medical Society, W. A. Buller, and Casy Wood, of New York, made a study of wood alcohol, and report a hundred and fifty-three cases of blindness, and a hundred and twenty-two deaths, from wood alcohol and remedies prepared from it.

Although the United States Pharmacopea is the standard of the country, it is not a compulsory document, except it is made so, by state enactment, hence we sometimes find a difference of seventy or eighty per cent. in the product of a drug as made by different manufacturers.

Tinctures, fluid extracts, and so forth, should be identical, within reasonable limits. Chemicals are often adulterated or impure, and chemical reagents marked C. P. in many cases cannot be relied on. Tinctures, have been found practically inert.

A few years ago, a joint committee, from the American Medical Society, and the American Pharmacutical Association, was appointed, to form some plan, whereby pure, and reliable, drugs and chemicals, could be produced, of definite strength, and uniform action, to be used as remedial agents. In their report, they deplored the condition, but no practical plan was given as a remedy.

Through greater facilities for purchase of the crude drug, a better understanding of what is necessary in its care and manipulation, one firm will produce a better and more reliable product of a certain kind of drug, than other firms. The same firm may fail to make the best brand of another drug. So it happens that physicians indicate their preference, by placing the initials of the manufacturer on their prescriptions. If another make of poorer quality, is used, in compounding the medicine, the druggist is guilty of adulteration by substitution.

As the pure food and drug bill was killed in the Senate, March 3, 1905, by substitution of another bill, the same fraud in filling prescriptions will for a time continue.

George Thomas Palmer in the Chicago Clinic tells how this is, done.

There's a druggist on the corner of a street thats near at hand.
(There are other druggists like him scattered o'er this honest land).
In a store large and handsome, with a smile that's soft and bright,
And you'll hear him, if you listen, say this same thing day and night:

"No, we haven't Fairchild's pepsin, but try this, if you would,
And take my word upon it, it is every bit as good.
We are out of P. D.'s tinctures", you will hear the druggist say,
"But I have a line that beats 'em and they're fresh this very day.
What? Bovinine? Take my advice, I really wish you would,
Here's one that costs a trifle less, but every bit as good.

Yes, Maltine? Sure, we have it here, but this is quite 'q. t."
I have a malt that knocks it out, made 'specially for me."
And if you'd follow this same man to his prescription place
You'd see a mercenary smile light up his shaven face,
And you would want to jolt him and you'd strongly wish you could,
As he fills the doctor's orders with "something just as good".

* * * * * *

I wonder if, when life is past and to the skies I go,
To be rewarded for my deeds of virtue here below,
When heaven I ask of Peter there, with cloak of white and hood,
He'll say, "Why, heaven's full today, but here's something just as good.

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THE INFLUENCE OF MASSAGE IN THE TREATMENT OF MENTAL AND NERVOUS DISEASES.

By M. N. Voldeng, M. D., Superintendent Cherokee State Hospital.

History—Massage in some crude form or other has been used from time immemorial by savage and civilized people. The reason for this is obvious, for almost every one instinctively seizes a place that is the seat of sudden pain, and attempts, with more or less success, to relieve it by rubbing or pressure, or by both together. Those who have thought it worth while to record their appreciation of massage have, in almost every instance, been men of eminence, either as physicians or philosophers, poets or historians, from the days of Homer and Hippocrates, down to these of Weir Mitchell and Kellogg. Among the Greeks and Romans, massage, in some form or other, was extensively patronized by people of widely different classes, from the patricians, the wealthy, and the learned, down to poor decrepit old slaves, and for the most diverse purposes; with some as a means of hastening tedious convalescence, with others as a luxury in conjunction with the baths, and with others still to render their tissues supple and enduring preparatory to undergoing feats of strength. The old slaves were submitted to such treatment in order to fill out their tissues and make them appear more comely, so that they would sell to better advantage by thus temporarily deceiving their purchasers. It was also used after the exercises and struggles of the athletes and gladiators; to stroke away and relieve the pains of their bruises, as well as for its reinvigorating effects.

Herodotus, the father of history, and others of his time, mention the advantages of external treatment of the human body; but it was not until about a century later that the first rational and definite information appeared on this subject, in the Aphorisms of Hippocrates. These embodied the wisdom of the past,, and presaged the developments of the future, to an extent that but few ancient or modern writers on massage have shown any evidence of appreciating.

"The physician must be experienced in many things', says Hupcrates, 'but assuredly also in rubbing; for things that have the same name have not always the same effects; for rubbing can bind a joint that is too loose, and relax a joint that is too rigid."

Definition—Massage from the Greek, **Masso,** I knead or handle; is a term now generally accepted to signify a group of procedures which are best accomplished with the hands, such as friction, kneading, manipulation, rolling, and percussion of the external tissues of the body in a variety of ways, with either a curative, palliative, or hygienic object in view. In many instances the massage is combined with movements which may be assistive or passive, resistive or active, as different cases may require; and these are often spoken of as the Swedish movement cure.

Method of Application—Vague generalities exist as to the manner of doing massage and these are not rendered much clearer by calling slow and gentle stroking in a centripetal direction **effleurage;** or by speaking of deep rubbing as **massage a friction,** or by using the word **petrissage** for manipulation without friction, or by calling percussion **tapotement.** Custom having sanctioned the use of these terms, it becomes necessary to mention them. These and other subdivisions of massage can all be grouped under four heads: friction, percussion, pressure, and movement. Malaxation, manipulation, kneading, or massage, properly so-called, is a combination of the last two. Each of all these may be gentle, moderate, or vigorous.

Some general remarks will save repetition: 1—All of the single or combined procedures should at first be used moderately, then gradually increased in force and frequency to the fullest extent desirable, and end gradually as begun. 2—The greatest extent of surface of the hands and fingers of the operator, consistent with ease and efficacy of movement, should be adapted to the surface worked upon, in order that no time be lost by working with the ends of the fingers, or one portion of the hands, when all the rest might be occupied. 3—The manipulator, if too near the patient, will be cramped in his movements; if too far away, they will be lacking in energy, indefinite, and superficial. 4—The patient should be in an easy and comfortable position, with joints midway between flexion and extension in a well-ventilated room, at a temperature of 70 or 75 F. 5—What constitutes the dose of massage is to be determined by the force and the frequency of the manipulations and the length of time during which they are employed considered with regard to their effect upon the patient. A good manipulator will accomplish more in fifteen minutes than a poor one will in an hour, just as an old mechanic working deliberately will do more than an inexperienced one working furiously. 6—The direction of the procedures should be from the extremities to the trunk, from the insertion to the origin of the muscles, in the direction of the returning currents to the circulation unless there be a plug in a vein. Friction may be circular or rectilinear; the latter may be parallel to the long axis of a limb or to the body, or at right angles, or transverse to the same. Transverse friction adds nothing to massage and may be omitted. In giving a general massage it is immaterial whether the upper or lower extremities be done first. It is better to be systematic and to divide the surface into convenient spaces. A convenient extent is from the ends of the fingers to the wrist, each stroke being of this length, the returning stroke being light and without removal of the hand. The frequency of these double strokes may be from ninety to one hundred and eighty per minute. From the wrist to the elbow and from the elbow to the shoulder, are each suitable areas of surface to be worked upon, and here not only straight-line friction extending from one joint to the other, but also circular friction, may be used. A combination of these two in the form of an oval, possesses the greatest advantages, both hands moving at the same time, the one ascending as the other descends on the anterior and posterior aspects of the arm, on the inner and outer surfaces of the upper arm, each stroke reaching from joint to joint, the upward being carefully kept within the limits of chafing the skin. It is well to begin these strokes on the inside of both arms and legs, so that the larger superficial and deep vessels may be first acted upon, as this influence extends at once, though indirectly, to their tributaries and ramifications. Time, effort, and effect will be made the most of by doing friction on the foot with the hands at right angles to it, one hand upon the dorsal aspect, and the other upon the plantar, moving alternately and in the form of an oval, the one ascending as the other descends. The lateral and posterior aspects from ankle to knee form a convenient territory, while the anterior and lateral aspects make another, for thorough and efficacious friction. The same systematic divisions of surface may be made above the knees as below, with the addition of another formed by the inner and anterior surface of the thighs, which will first receive attention. The number of strokes below the knee should vary from one hundred to one hundred and sixty with each hand; above the knee from sixty to one hundred. From the base of the skull to the spine of the scapula forms another region, naturally well bounded for downward and outward semicircular friction; and from the spine of the scapula to the base of the sacrum and crest of the ilium forms another area over which one hand can sweep while the other works toward it from the insertion to the origin of the glutei muscles. The chest should be done from the insertion to the origin of the pectoral muscles, and the abdomen from the right iliac fossa in the direction of the ascending, transverse, and descending colon. The force used in producing friction is often much greater than is necessary for it should only be intended to act upon the skin; manipulation and percussion acting much better on the tissues beneath. If redness and irritation of the skin is the result aimed at in friction, then a coarse towel or brush would answer for this purpose a great deal better than the hand alone. However for intelligent variation of pressure, agreeableness of contact, and adaptability to even and uneven surfaces, no instrument has yet been devised to supersede the human hand. In union there is strength, and the fingers should be kept close together in doing friction as well as manipulation.

Physiological Effects of Massage—The pressure of massage exerts a simultaneous influence upon all the tissues within its reach —upon skin, fasciae, muscles, blood vessels, lymphatics, nerves, etc.

Though the skin in its natural condition, is tough, flexible, and elastic, it is rendered none the less so by a prolonged course of massage. On the contrary while it becomes softer, suppler, and finer under manipulation, it also at the same time becomes more tough, flexible, and elastic, so that whereas, at the beginning of massage it could scarcely be gently pinched and grasped without hurting, later on the patient will often delight in being almost lifted up by the integument like one of the agile domestic animals; thus showing also a marked change in its sensibility. The soothing effect of gentle stroking is familiar to every one, and the anæsthetic effect of vigorous pinching so that a hypodermic needle can be inserted without pain is also well known. Insensible perspiration, when deficient, is increased. Weynrich has demonstrated that by the mechanical action of friction the excretion of water through the skin can be increased sixty per cent. or more. The sebaceous secretion is facilitated by massage, as is evidenced by the moisture and gloss of the hair after manipulation. For rousing the action of languid skin alone, friction, pinching, and percussion would commend themselves. In malnutrition from digestive, respiratory, and other disturbances, inunction has often proved an efficient means of furnishing nourishment to the system when other means have failed. The skin is in the best condition for absorbing oils towards the end of an application of massage when its circulation has been thoroughly aroused. For this purpose a preliminary warm bath is of great aid. The normal function of the superficial fascia in facilitating the movements of the skin over the subjacent tissues is favorably influenced by massage, especially when there exists a tough, matted, hide-bound condition; and this, if looked for will be found as often in the human race as in the equine, indicating that there is limited action of body as well as mind. Its diagnosis and removal are accomplished by the same means, and the superficial vessels and nerves that pass through this fascia are thus freed from hindrance of pressure besides being themselves acted upon directly. Grasping a convenient portion of the skin, and slowly moving and stretching it, effects this object most easily. Muscles by their intermittent compression and relaxation exert a sort of massage upon each other. The ascent and descent of the diaphragm in respiration make continual massage and passive motion upon the organs above and below it, more especially of the abdominal and pelvic organs; and when its movements are limited from want of exercise or restrained by tight lacing, it is only too familiar how feeble are appetite and digestion and how constipated the bowels become. The voluntary muscles should receive about one-fourth of the total amount of the blood in the body, and their vessels may with propriety, be considered as derivative channels for the relief of hyperaemic conditions of internal organs. Their action presents a great similarity to that of a beating heart, for at every contraction the blood is driven out of them, and by this means it at the same time receives an additional impulse in its return to the heart, while at every relaxation the vessels are again allowed to fill. The parallel may be carried still further in order to point out a practical lesson: for the heart, which is abundantly supplied with blood for its own nourishment, lasts a life time usually without fatigue, though in constant activity, while voluntary muscles, if allawed to remain inactive, soon suffer in size and strength, or the circulation will follow the paths of least resistance and go around rather than through them. Hence the importance of some measure that will overcome the evils of inactivity, that will at once attract the circulation to the muscles, and at the same time aid it in its return. This indication is better fulfilled by the intermittent pressure of massage than by any other known means, for plain common sense, without elaborate physioligical experiment, tells us that massage must make more blood go through the skin and muscles, and consequently less to the brain, spinal cord, and internal organs generally. Not that the effects of massage and exercise are alike in all respects, and that massage is only a substitute for exercise and nothing more, as some will claim, for voluntary exercise means exercise of the nervous system quite as much as of the muscular, and some times more: besides, the cases that are often benefited by massage are those of overtaxed brain and used up nervous energy, to whom exercise, in the ordinary sense, must only increase their exhaustion and who yet require a mechanical stimulus for their nutritive functions. True, a certain store of latent energy is necessary in order to undergo massage, but this is much less than would be required for voluntary exercise, were this possible. Fatigue is an indication that waste is greater than repair. Muscular fatigue from over exertion or want of exercise is relieved by massage, which promotes a more rapid absorption of waste products and stimulates the tardy peripheral circulation, upon which weariness to a large extent depends, thus showing a marked difference between the effects of exercise and those of massage. Mental fatigue is often relieved by the same means, which increases the area and quantity of the circulation in the external tissues of the body, and thus depletes the overfilled or relaxed cerebral vessels.

Massage in Affections of the Nervous System—It should be remembered that massage may be of primary importance, or of secondary importance, of no use at all, or even injurious. Upon the nervous system as a whole, massage most usually exerts a peculiarly delightful, and at the same time profoundly sedative and tonic effect. While it is being done, and often for hours afterward, those who submit to it are in a blissful state of repose; they feel as if they were enjoying a long rest, or as if they had just returned from a refreshing vacation: it makes optimists of them for the time being. An aptitude for either rest or work generally follows though usually those who submit to the treatment feel gloriously indifferent, and needless apprehensions are dispelled. Hence its usefulness in many varieties of melancholia, especially those forms accompanied by trophic and vasomotor disturbances, and where dementia is threatened after an attack of excitement; for under this treatment mental comfort and a sense of well-being take the place of apathy and lassitude. Through the medium of the central nervous system, even local massage is radiated or reflected throughout the body, thus acting at the same time as a nervous and vascular revulsive or physiological counter-irritant, if one may be allowed this expression in contra-distinction to pathological counter-irritants, such as blisters or rubefacients. Massage of the back alone will often relieve headache, and of the limbs alone will frequently put a restless patient to sleep. As to the range of its usefulness, experience and observation have shown that at tolerably definite stages in one or more classes of affections in every general and special department of medicine, it has proved either directly or indirectly bneficial, or has led to recovery when other means had been but slowly operative or apparently had failed altogether. In what affections and at what stages may massage be beneficial? Briefly answered, in local and general disturbances of circulation, locomotion, and nutrition, either in their incipient stages or after acute symptoms have passed away. At the commencement of many affections, local congestion and irritation can often be relieved by massage, and this may serve as a cure or prevention of further mischief. In cases that have come to a standstill or lapsed into chronic condition, languid circulation can be aroused, waste products absorbed, and nerves and muscles nourished and strengthened. Of late years, massage has been considered of great importance in the treatment of neurasthenia, and often without very clear notions as to its relative value in various forms of this disorder. Neurasthenia is the background to the picture of nearly all diseases and injuries, whether of an organic or functional nature, but for our present purpose we will regard it from other view points. First there is the natural and not unpleasant fatigue, the result of an active and satisfactory days work, from which we recover by food and sleep. Then comes the fatigue from which we do not recuperate as usual, the fatigue of being over worked, worried, or "played out".

Here rest and change of scene are of the first importance; but if these are impracticable or without effect, massage together with tonics and sedatives, will prove of much benefit. Encouraging success has attended the use of massage in chorea, without much regard to the pathology or causation of the affection. It is generally agreed that the seat of this malady is for the most part in the brain, though the spinal cord and peripheral nerves may, and generally do, share in the disorder which is of such a nature as to weaken the force of the nervous system without destroying. If the erratic movements were due to organic disease of the brain or spinal chord, we should not expect much benefit from massage or any other treatment. However, rest, massage, and an abundance of easily digested food have proved successful in the early and acute stage of the disease; in the decline of the malady, when slight irregular movements still linger, massage, exercise, and calisthenics have done well. In the milder forms of neuralgia, and in the incipient stages of more severe attacks, as well as in old cases of neuralgia, where almost every known means had been exhausted but massage, this has been tried and it has not been found wanting in favorable results.

Used between the paroxysms of severe neuralgic pains, massage generally lengthens the intervals between these attacks, and lessens the severity of them when they come on. Pain arising from disturbance in the central nervous system is frequently relieved by massage, though it is difficult to understand how it does it. In peripheral neuralgia, where the affected nerves themselves can be reached by massage this ought to be much more effectual. In peripheral paralysis massage will often hasten recovery even after the affection has been at a standstill for some time. The benefits that might result from massage or any other remedial agent in disturbances arising from organic changes in the central or peripheral nervous system, will depend more on the nature of these changes than on the merits of the treatment. So many variations are seen in the course of paralysis of central origin, that the influence of massage in modifying these is difficult to determine, even if it were always judicious to make use of this treatment from the first. When paralysis of central origin has come on suddenly, massage should not be thought of until after the danger from inflammatory reaction has passed and all general disturbances have subsided. Briefly stated, all vaso-motor and trophic disturbances, are rational indications for the use of massage, either as a preventive of these changes, or as a palliative of them when they have taken place. In hyperaemia of the brain and its membranes, whether due to an increased flow of blood or a hindrance to the return of a normal flow, gentle massage of the neck, so as to hasten the current in the jugulars, has a rapidly depletory effect, similar to copious blood-letting or compression of the carotids, but without the possibly injurious effects of either of these. The pressure of the blood in the cranium can thus be quickly lowered, and it should prove an excellent preparatory measure to the use of other depletory agents in many, if not all, conditions of acute central hyperaemia.

The domain of local and general massage is too vast for even the most general discussion in the time usually allotted to a paper of this kind. One can hardly leave the subject, however, without at least referring to the latest curative system in medical practice, namely, osteopathy. In his work (Therapeutics of Local Massage) Dr. John K. Mitchell has the following to say of the "new school": "The fact is that if all educated physicians really knew and appreciated the proper place and value of massage and other forms of mechanical therapeutics, and made right use of the knowledge, the osteopaths would never have had a chance: for, let them say what they will, if study of their books makes any one thing certain about the system, it is that they have found out and exploited the usefulness of massage and manipulations". In a recent article (American Medicine) Dr. R. C. Newton, states that the practice is of old Italian origin and sums up osteopathy in the following paragraph: "Whatever permanent good the osteopaths do, they do by mental suggestion, followed by massage and manipulation, and in some cases by hydrotherapy and the use of heat and cold. They probably accomplish more than ordinary masseurs because they are fiercer and bolder in the application of their methods. The lesson they teach is that the human frame cannot only endure but can be benefited by maneuvers which are usually regarded as so severe as to be dangerous.

To teach people the necessity of bodily exercise, if they wish to enjoy good health, has been and still is a difficult and discouraging task. But the people are learning their lesson for all that; and the osteopaths are contributing (albeit unwittingly) their share to the fund of human knowledge".

In conclusion I would like to suggest the importance of providing each of our State Hospitals with all modern facilities for the scientific administration of massage as well as hydro and electro therapeutics.

CLASSIFICATION OF INSANE CONDITIONS.

By Max E. Witte, M. D., Superintendent of the Clarinda State Hospital.

Classification is a specific instance of a common mental process—abstraction, and involves both the analytical and synthetical powers of the mind. The abstract is based on and derived from the concrete by conceptual separation. That is, the more general truth is obtained from the more special. To have the abstraction truly and fully represent reality it is necessary not only that the mind should have a profound and comprehensive grasp of the subject in order to resolve from it its attributes and among these to distinguish and separate what is essential and universal from what is trival and accidental, but also the observational powers must be keen and accurate so that the representation in consciousness may be clear, just and fair, and the experience of ourselves or others may serve as an unimpeachable witness and give true evidence in the high court of reason. It would indeed be interesting could we stand aside and have the past unrolled before us like a scroll even if no farther back than that point in the history of our race, when the first glimmering of reason flickered up, that divine spark which, as St. Augustine says, is part of the uncreated intelligence of God. Man at that stage in his development, as before and since, was tutored by a stern mistress—necessity, the Anangke of the old Greek to whom even the gods bowed. It is probable then, that primitive man struggling for his existence and surrounded by inimical forces encountered qualities and properties in different things injurious and hostile to his life and welfare, and which as a warning to his fellows he expressed by a characteristic grunt, which in the course of ages developed into the Roman, "malus" or the Saxon, "bad." On the other hand, he experienced agreeable, wholesome and favoring properties and functions associated with other objects, and no doubt a second primitive adjective was coined, and a second series of things mentally linked together in a class, subject of the predicate—good. Thus, perchance, originated the first great classification of our ancestor of all things coming under his ken into good and bad. From which, with later mental development came the general abstractions so vitally interwoven with the spiritual history of our kind, good and evil. From such beginning also came language keeping even step in development with growing reason to serve as a form, a symbol of our mental product, and at the same time to be a preservative and a vehicle to communicate it to our fellow.

By classification then our intellect finds means for its own ease, convenience and advancement, but it also at the same time is subservient to the primal condition laid by the Supreme Builder upon the universe—order. And the science of taxonomy to be true, that is valid and enduring, its product must be above time and space, and conform to reality in so far as we can know it at any time. It is necessary then that the attribute or association of attributes on which classification bases its grouping is fundamental and essential; moreover is persistent and invariable, that it is the same at any time and at any place; even that it is universal, that when or wherever the subject is found, the attribute is also there. Nay, more, that in my mental archives the attributes lies intimately wrapt up in its subject, even so that by communicating the sign, symbol or name of one or the other to my neighbor, in his consciousness will arise the same association of subject and attribute in image or conception.

That the rigid requirements indicated are met but rarely, is alas only too true. We live in a world of phenomena, of mirrorings in our mind—of appearances, of shadows. Noumena or things in themselves we do not know. Veiled like the image at Sais, they are hidden from our present ken. What shall we behold when the veil is lifted?

The best we can do with our limited and restricted mental powers is faithfully and truly to combine in conception according to sequence or association, what universally so together impresses our consciousness. In some of the sciences, especially those dealing with the manifestations of matter in its less developed forms, wherein its expressions are laid in simpler, fixed and rigid order, a fairly satisfactory classification is possible. But when we ascend on the trail of envolving matter, our difficulties grow manifold to find the immovable, the true, the eternal, amidst the whirl of circling, ever ascending, anon descending nature. It is difficult to observe the flying shuttle, the juncture of warp and woof in the elaborate pattern of universal existence unrolling from nature's loom.

Says the Earth Spirit to Faust:

> "At the humming loom of Time,
> I weave the garment Deity wears."

As we enter the domain of the biological sciences, constants, mathematically speaking, grow fewer, variables grow in multiplicity and complexity. This is the more marked the nearer we approach the vertex of the pyramid of the sciences. Very closely situated near this vertex is psychiatry or morbid psychology.

A rational, that is "safe and sane," psychiatry can only be reared on a sound psychology and the latter again on a true physiology. But psychology is very far from being an exact science in the sense in which we use this term in speaking of astronomy, physics, or even chemistry. Vast regions in the psychological realm are still uncharted and unknown, practically a terra incognita. While this is true, classification in psychiatry cannot be rational, but necessarily in the present state of our knowledge must be descriptive and at best only tentative and provisional. The most ambitious, certainly the most consistent classification of insane conditions in my opinion is that of Prof. Theodor Ziehen. It is based on his system of physiological psychology. But in the latter so much is schematic, so many inter and correlations are unknown, perhaps even unsuspected, so many unknown quantities for which there are no equations enter into the problem, that it lacks completeness and finish, and consequently does not fully cover reality. While logical and sound in dealing with known factors, and uncovering nuggets of virgin gold in his delving, his system in my humble opinion is in a measure vitiated by materialistic determinism. Nevertheless, one cannot withhold admiration from this author. He is suggestive and stimulative of thought and well worth anyone's time to read even if we cannot always endorse his positions.

I have neither the time nor inclination to refer to a number of lesser lights in our profession who have essayed in this direction. Some of these gifted with a certain facility of graphic expression, with more imagination than judgment and without a sense of their limitation, erupt into notice as iconoclasts, and architects of a brand new classification of insanity based upon a new "patent applied for" set of views.

A common source of defect and insufficiency in the product of these classifiers is the possession of a shallow, incomplete and even inconsistent psychic knowledge, or they adhere to the archaic psychology wherein feeling, thinking and willing are held as a fixed and mutually independent trio of entities. It thus comes that these people speak of monomania and imagine the contents of one psychic compartment disordered while that of others is sound and unaffected. They will tell you that in a delusion the insane person reasons correctly, but from false premises, or they will call upon unknown or hypothetical elements to enter as basic factors in the causation of insanity, and then go on to build as if their foundation were well established.

If classification of the insane conditions from a psychological standpoint at this time is not entirely feasible and satisfactory, the same must be said of it taken from an anatomical or morphological point of view. While many patient, able and competent investigators are at work delving in the field of pathology, searching and occasionally finding morbid changes in the structure of the brain, basic and causative of the mental aberration, still so many insane conditions are of a functional character, and the changes in structure are too minute, possibly molecular, so that they are not recognizable with our present means. This in a great measure explains the comparative barrenness as to epoch-making results in pathology in our laboratories connected with hospitals for the insane as well as elsewhere where work is done in this field. It is not for lack of endeavor or earnestness or ability enlisted in research. Nevertheless, it is in this region that we must look for light and advancement in our knowledge. Perchance we shall find in the unrolling years of the future more powerful and refined instruments of research, more subtle and delicate methods to resolve the mysteries and molecular mechanics of the cortical brain cell. And even should we gain a complete and satisfactory mastery of cerebral physics, I am not fully convinced that we shall have all necessary data to construct a true psychology. The physical and psychical run side by side in parallel lines throughout the All. The thought that shapes the destiny of empires has no equivalent in measures of heat. No one has ever demonstrated, or perchance ever will, the kindship in esse of patriotism and bile.—Spirit then while joined to and the lord of matter is not its product, and in my humble opinion the psychology representative of fact, will involve vastly more than an exposition of matter alone, be it ever so highly developed.

What has been said of psychiatrical classification founded on histology applies with equal force to that based on etiology or causation. The forces or influences instrumental in the production of mental alienation are fairly well understood in a few forms of insanity and due recognition is given to this in most classifications of insanity in vogue. Nevertheless, in the preponderating majority of insane types the causes are still unknown. We speculate and labor in this field to clear up our knowledge in the well-founded hope of achievement and light. In the meantime it is the part of wisdom to bear in mind the maxim of Newton; "Hypotheses non fingo," to recognize the grave elements of uncertainty and inexactness entering into our own theories, rendering them as yet entirely unfit for purposes of classification. In the meantime it is a duty we owe the spirit of our progressive race to keep our eyes wide open to facts having bearing on the problem, ever alert to observe associations, sequences, trends and tendencies, and to group and associate them into a provisional tneory in the absence of established truth. In such a case theory is better than nothing and is permissable. To be worthy of consideration it must be logical and internally coherent and consistent. The facts observed must fit in and be harmoniously enveloped by it. The more vital facts encompassed, the greater is the probability of the theory approximating the truth. One well-established fact running counter to it reduces it to zero.

It may also be said, that we can justly deal with observed acts as facts, even if we cannot yet establish the causal connection of antecedent conditions, or the modus operandi in the production of subsequent events. We may see and grasp individual links in a chain, though its remote and ultimate members may escape us. This much in justification of our talking about the causes of insanity; the overshadowing influence in its production, of heredity for instance. He must indeed have mental occultation, who does not observe hereditary predisposition to insanity as a vast and most important factor in the causation of insanity. But what inherent obliquity, what structural defect, what developmental twist, what locus of evil and disaster to future generations is involved and transmitted in the meeting and commingling of the paternal and maternal cells in conception is unknown. We do not know. We here stand before the mystery of mysteries, the appearance of a new being on the stage of Life.

Science is popularly held to be a dispeller of marvels. Gentlemen, it is not so. It opens vistas untraversed, immensities unexplored, profundities unfathomed; it leads to reverence and awe; it engenders humility by placing in contrast us little observers with the limitless vastness to be observed about us, yet it kindles rational pride in that we are observers and kindred with the Supreme Builder and Master. Still in modesty are we mindful of the quatrain of Omar Khayyam:

"Up from the Earth's Centre through the Seventh Gate
I rose, and on the Throne of Saturn sate,
And many a Knot unravel'd by the Road;
But not the Master-knot of Human Fate."

There is no doubt, however, that when our psychical knowledge shall have become more nearly perfected, the etiological, equally with the morphological factor will play an important role in a future adequate classification in the field of psychiatry. The principle of causality demands no less. We cannot conceive other, than that a like cause under like conditions will produce a like effect. Much good work is done in research in this domain, and we are encouraged to hope that as the years pass by, we shall have fewer and fewer types of mental disorder left with the cause or causes unknown. This much may be considered well-established, that while all insane conditions are disease, and moreover disease of the brain, in many forms of insanity this diseased condition of the cerebral cortex is really secondary, and the primary disease is located elsewhere and is either generally systemic or the morbid derangement of some organ or organs essential to animal life. This has been pretty generally understood for years; for instance, in paresis dependent on an antecedent syphilitic infection. It is also the opinion of an increasing number of competent observers that such forms as melancholia, grave delirium, the manic-depressive types, myxedematous, and probably the early dementias are due to autointoxication; that is, to a poisoning and impoverishment of the brain by injurious products engendered within the economy of the human body. Some organ is at fault, and the brain as most highly organized and influenced by adverse metabolism, suffers most. And if this nutritional disturbance is profound or enduring, structural changes in the brain elements ensue with a fixed morbid mentalization.

In the so-called toxic insanities, chiefly caused by the continued inundation of the brain by either alcohol, morphine, cocaine, chloral or the like, the morbific principle is introduced from without, and the effects are specific and quite well defined.

We come next to classification reared on symptomatology; that is, on the signs and manifestations of the disorder. This is the easiest and most readily to our hand, and at first view would seem the most obvious and natural. In fact, the classifications of insanity in the past have with but few exceptions been of this character. Moreover, by far the greater number of classifications in vogue at institutions for the insane are either entirely based on the symptoms, or symptoms and causes mixed. To the layman this would appear unobjectionable, since it is by means of the symptoms we recognize disease. Nevertheless, this method is erroneous and involves a fundamental fallacy. Symptom is not disease, but only the manifestation of disease. General medicine has long ago recognized this in its classification. A classification on some one predominant symptom would place under the heading of fever such different diseases as typhoid, ague, rheumatism, pneumonia, small pox, meningitis, quinsy, and a multitude of other ailments entirely unlike in origin, course, danger and termination; and especially, what is more to the point, different in requirement by treatment. And we really find in the symptom classification of the older psychiatry, diseases wholly different in essence grouped together under the name of some prominent sign of disorder. Moreover symptoms vary by individual peculiarities in the makeup of the patient and change in the same patient with the course of the disease. Further, in classification based on symptoms, the personal equation of the observer or classifier enters and usually colors with personal views and impressions the result. In the diversity of different mentalities, it is perhaps natural that equally good and competent observers in psychiatrical matters should have different views taken from different standpoints; nevertheless, the difference is regrettable and a hindrance to psychiatry. Indefiniteness and looseness of language argues lack of clearness and definiteness in understanding. We cannot have full solidarity of aim, purpose and effort in a science until the language which symbolises its spirit is uniform, and its terms convey the same meaning to you and me. As witness to this, I refer you to the mathematical sciences.

You may gather from the foregoing that there is a sad want of harmony in the classifications of the psychiatrical field. What do we really find? Chaos, and confusion worse confounded. It seems strange that identical types of mental disorder should be so differently viewed. But on closer analysis it is found that there is a fair agreement on many forms which are well defined and are thus retained in the various classifications employed. Also the designation of prominent symptom complexes are quite commonly and generally employed as generic names. But when it comes to a more specialized subdivision of these more general types, we find the finger marks of the reformer and improver much in evidence. In 64 reports of institutions for the treatment and care of the insane coming to my desk recently and picked up at random, are 53 different classifications employed. These figures require no comment. In these 64 reports were three reports of hospitals for the insane in New England in which the classification was alike; that of Kraepelin being employed. Also the classification of four New York hospitals was uniform, but was not Kraepelins. The classifications embraced all sorts of numbers between six classes in one instance and forty-four in another, and as a curiosity it may be mentioned that the reports in which the maximum and minimum are found come from hospitals in the same state. Six reports contained no tables covering the mental disorder, though in most of these, tables were found carefully setting forth how many men were born in Ohio and how many in Indiana; or how many were Methodists and how many Baptists. Was this an oversight or are only "just insane" people treated at these institutions. In these 53 different classification tables referred to, the subdivisions of mania range from 0 to 13; those of melancholia from 1 to 11, and that of dementia from 1 to 10. One table classed aphasia and chorea as insanity. One report tabulates both pubescent and adolescent insanity. Will some learned colleague enlighten me as to the difference? Four reports omit such a well-defined type as paranoia from classification, nor could this form be discovered under any other name. One institution has no paretics among its insane; at least general paralysis is not on its list. In three hospitals a modified Kraepelin classification is in vogue, but the modifications are different. It is further apparent that there is no more harmony elsewhere. The reports consulted came from institutions in the United States and Canada with the exception of two from Scotland. The classifications in these two reports are widely different.

A similar condition exists in the text books of psychiatry. Classifications peculiar to the author are found in Clouston, Blandford, Spitzka, Bucknill-Tuke, Maudsley, Kirchhoff, Wernicke, Krafft-Ebing, Kraepelin, and, as previously mentioned, Ziehen. Berkley in his excellent Treatise on Insanity has adopted in toto the classification of Krafft-Ebing, which by the way is a good one. Of Kraepelin's classification I shall have more to say anon. No one realizes and feels more keenly this want of harmony in classification than the authors themselves.

Kirchhoff says: "The classification of insanity is the most difficult problem in scientific psychiatry. None has hitherto proven satisfactory, and my own classification undoubtedly possesses many defects."

Clouston: "Though our nomenclature for the deviations from normal mentalization is as yet unscientific and incomplete and must one of these days be revised, yet most abnormalities are capable of being in some way described and classified."

Spitzka after having much good to say of Krafft-Ebing's classification, still finds it too inelastic. He eventually says: "It may be readily surmised that where the best thinkers have failed to produce an unexceptionable classification, the failure must be due to some inherent difficulty of the subject. Few cases of insanity are exactly alike in all respects."

Maudsley states: "Much discussion, into which I shall not enter here, has taken place at different times concerning the proper method of classifying the varieties of mental derangement, and as many as forty or fifty different systems of classification have been propounded, a sufficient proof that no one has yet been found to be satisfactory.

Krafft-Ebing says: "Ever so much is still to be accomplished in order that psychiatry, which at present can scarcely lay claim to more than that of a descriptive, may rise to the dignity of an explanatory science." However he is optimistic and proceeds: "But while right here apparently insoluble problems are placed before the human understanding, nevertheless the results of scientific research gained in such a short time, and the unbiased labors in all civilized countries of capable investigators in the various fields of psychiatry, are guarantee of its fruitful development. Its next and attainable goal at least for a scientific point of view, will be its resolution into cerebral pathology."

Kraepelin says: "While at present we must still lack a well-rounded classification, say in the sense of Linne's for all time, and the setting up of scientifically firmly established types, nevertheless practical needs require even to-day, at least a provisional grouping of the raw material of experience, which will be the more of enduring value the less it is influenced by preconceived opinions in the evaluation of facts."

Some ten years ago, if my memory serves me right, the most representative body of practical workers in the psychiatrical field in this country, the American Medico-Psychological Association, essayed to relieve the need and appointed a committee to serve until it had devised a comprehensive and satisfactory classification of insanity with which all might agree and for general use in the hospitals and institutions for the treatment of the insane in the United States and Canada. After a few years' labor the committee sent out a provisional classification giving the impression, however, that it was provisional only, and a forerunner of the real thing to come. I have heard nothing further in the matter and if the temporary classification promulgated has been adopted anywhere, I do not know it.

While classification reared on symptoms is shallow, discordant, and unsatisfactory and that on an etio-anatomico-psychological foundation is as yet impossible, we have still another basis on which to group insane conditions, and that is the clinical. A classification founded on the natural history of disease; that is, its rise, behavior, course and termination, is the one employed in general medicine to such advantage and marks a distinct advance on the old empyricism contemplating symptoms only. Such a classification of insane conditions is that of Kraepelin. It is not perfect and by no means final. No one realizes this better than Kraepelin himself, as witness quotation from his work on psychiatry read awhile ago. In part his system has not crystallized into rigid forms and some types are indefinite, and this on account of variation in diseases effecting mentalization. Nevertheless, his system in my opinion is more than any other more nearly in consonance with observed facts in psychiatry. It is plastic and adaptable to new discoveries; moreover, it is eminently practical and stimulative to observation and research. This classification is employed by some of the foremost scientific workers in our special field. Besides more and more institutions, where psychiatry is best served, are adopting it. Says Dr. Adams, Superintendent of the Westborough Insane Hospital of Massachusetts, in his last report:

"We have adopted this year the classification of Kraepelin in making diagnosis of mental disease. This, although unfortunate in some of its terminology, is much better than any other hitherto presented to alienists."

I subjoin here to the classification of Kraepelin, as found in the last edition of his work on psychiatry, with the recommendation that it be adopted in the state hospitals of Iowa, as the best for our needs extant. I believe the majority of my colleagues in the assembly will agree with me in this. It is only justice to a former management at Independence to say that this system was in vogue there at one time. The classification now employed in the hospitals of the state leads easily and with little resistance into that of Kraepelin. It is merely paraphrased from and more generalized than the Kraepelin classification. But it is thought very desirable to subdivide the general groups more fully, and in order to be in unison with other excellent hospitals in this country, that the terminology of Kraepelin, cumbersome though it is perhaps, be employed in the future, hoping ever and working always to the end that coming days will bring more knowledge and order in an obscure and little explored field of human endeavor upon which we may rear a true and abiding classification.

KRAEPELIN'S CLASSIFICATION.

I.—Infection Psychosis.
    A. Fever Delirium.
    B. Infection Delirium.
    C. Infection Weakness (Neurasthenia).
II.—Exhaustion Psychosis:
    A. Collapse Delirium, (Acute Delirium).
    B. Acute Confusion, (Amentia).
    C. Chronic Nervous Exhaustion.
III.—Toxic Psychosis:
  1—Acute Intoxication.
  2—Chronic Intoxication.
    A. Alcoholism.
    B. Morphinism.
    C. Cocainism.

IV—Thyrogenic Psychosis:
- A. Myxedematous Insanity.
- B. Cretinism.

V—Dementia Praecox:
- A. Hebephrenic—form.
- B. Katatonic—form.
- C. Paranoid—form.

VI—Dementia Paralytica; (Paresis, General Paralysis).

VII—Organic Dementia.

VIII—Involution Psychosis:
- A. Melancholia.
- B. Presenile Insanity.
- C. Senile Dementia.

IX—Manic-Depressive Psychosis:
- A. Maniacal States.
- B. Depressive States.
- C. Mixed States.

X—Paranoia.

XI—Neuro-Psychosis:
- A. Epileptic Insanity.
- B. Hysteric Insanity.
- C. Traumatic Insanity.

XII—Degenerative Psychosis:
- A. Constitutional Perversion.
- B. Compulsive Insanity.
- C. Impulsive Insanity.
- D. Sexual Perversion.

XIII—Arrested Psychical Development:
- A. Imbecility.
- B. Idiocy.

WHAT CAUSES TUBERCULOSIS.

By L. F. Summers, M. D., Milton, Iowa.

About one year ago a bill was introduced in the Legislature asking for an appropriation for the purpose of building a Sanitoria to care for and treat the poor consumptives of the State of Iowa.

The bill did not pass in its entirety, but an amount was appropriated and placed in the hands of the Honorable Board of Control to investigate and find out if the condition was true as had been presented to the General Assembly. The result of their investigation has revealed the fact that the conditions are much worse than were represented at the time.

The investigation of Tuberculosis has opened up a new field of thought and study among the laity (and even among some of the physicians) that but very few thought of a short time ago.

With the great amount of enlightenment and facts brought out by this investigation, but few, if any of the members of either branch of the General Assembly, could bring objections to a measure fraught with so much good to the poor unfortunate consumptives.

The Board of Control sent out inquiries to all the physicians in the State, and the appalling fact was revealed that more than double the amount of people were dying annually from Tuberculosis than was represented to the General Assembly last winter.

A prominent physician and expert in an Eastern city made the statement in a lecture, that Tuberculosis was the most prolific source of poverty, crime, insanity and degeneracy in the world. This being true, certainly it is necessary for every city, town and hamlet in the country to exert itself to put forth heroic measures to stamp out the most common and dreaded of all diseases.

Early in the winter Secretary Hay transmitted to the House of Representatives a report, and the best means of combatting and treating Tuberculosis, and avoiding its propagation in penal institutions of every kind.

These facts I merely cite to show you the great desire of well-informed people everywhere, and that they are putting forth as determined an effort as possible to stop the spread of the unfortunate disease.

Most every State through its legislative bodies or through strongly organized charitable institutions are taking special steps to prevent the ravages of Tuberculosis.

There is no question but that by proper methods of treatment in a well-equipped Sanitoria that seventy per cent of the early cases can be cured and made useful citizens. Is it not worth while to try and make the effort? Who can make the estimate of what it would be worth to mankind? Your own family is in danger, the dreaded disease is lurking everywhere.

You send your son or daughter to college for three or four years and they are confined most of the time in close rooms at hard study, the system becomes relaxed and debilitated; in such conditions they may possibly come in contact with the dreaded germs. Tuberculosis develops, and a promising, beautiful life is soon ended.

Then the inquiry is made, where did it come from? We have no consumption in our family. Let me say to you, Tuberculosis is not transmitted from the parent to their offspring, never; but finds its way in the human system through inhalation mostly.

The bacillus or germ that produces the disease abounds everywhere; the consumptive spits on the streets, in the cars, churches, or any place that may happen to be; the sputum becoming dried and mixed with dust is blown in the air, and through the mouth finds its way into the lungs and other parts of the system, and starts up its deadly work. A rugged, stout person can throw the germs off, but the weakly, debilitated, scrofulous person can not, and they sooner or later develop into a hopeless case of Tuberculosis and have sown the seed for other victims.

The solution of how to get rid of consumption entirely, will never be, but by far the most effective method is education and enlightenment through the Sanitoria plan of treatment. There the patient is taught the value of simple and nutritious food, fresh air, plenty of sun light and regular habits of life, and the most important of all, is to learn how to destroy their sputum and to disinfect every particle of clothing.

Every patient saved by the Sanitoria plan of treatment goes out into the world a great missionary and acts as an educator for the people, therefore performing a double function; that of teaching others the great principle of saving human life, and thereby helping to arrest the great white plague.

It has been demonstrated that the drug treatment per se, is practically useless, but if used scientifically in connection with the Sanitoria plan would bring forth marked results.

Many of the advertised patent nostrums for the cure of Tuberculosis are criminally harmful, and I believe have hurried some to their grave by their use.

I hear some say that the climate of Iowa is not suitable for such a line of treatment; however, it is believed by many good physicians, that in the treatment of Tuberculosis, it should be treated under the same climatic conditions as that which they are likely to experience in after life. It has been observed that patients that have been benefited in some other altitudes, where the climate is different, upon their return to their former climatic conditions, readily succumb to their old troubles and their disease will run its course very rapidly.

One of the best articles I have read is in the January number of McClure's Magazine. It would be a great source of education if it could be read by all desiring light on the subject of Tuberculosis. I have taken the liberty of making some quotations from it. There are three great questions in the Tuberculosis crusade to which every citizen can, by lending his countenance, be of service to his country:

First—The education of the people in the real problem.

Second—The building of Sanitoria for the consumptive poor.

Third—The enactment and enforcement of wise legislation.

When these three are accomplished the beginning of the end of the great white plague will be at an end.

THE THERAPEUTIC VALUE OF AMUSEMENTS IN STATE HOSPITALS FOR INSANE.

By J. W. Wherry, M. D., Assistant Physician Clarinda State Hospital, Clarinda, Iowa.

The employment of amusements as a therapeutic measure in hospitals for insane, and the benefits to be derived therefrom, is not only a subject of interest but of importance. The belief in their efficacy is universal, but the practical application of this belief is surrounded by difficulties and frequently subverts the end it seeks to accomplish. If amusements are to be used merely as a species of diversion calculated simply to tickle the risibilities of the patients or, indeed, are calculated, on the other hand, to drive the patient to the point of distraction and make him forget his present woe in the experience of a keener torture, it matters little what the form of amusement, or when or by whom supplied; but if amusements are to be regarded and employed as a therapeutic measure, then their administration is raised to the dignity of an art, and their management can no longer be safely left in the hands of a layman, however proficient he may be in the practical work of producing them, but must receive the same professional care and attention as any other method of therapeusis.

The great trouble with amusements in many hospitals, shall I say in practically all hospitals, has been that, while they have been regarded as possessing some therapeutic advantages, they have been employed merely to put in the time, or because other hospitals use them, or, indeed, because the public has been led to expect it. The employment of entertainments in hospitals for such purposes is equivalent to treating rheumatism with static electricity simply by bringing the patient near enough to see the "spark." A static machine in full operation and producing a ten or twelve inch spark may overawe the public and astonish, or even frighten the patient, but this exhibition will not cure the rheumatism; and amusements administered in a haphazard, unprofessional manner can produce as much, or more insanity than they relieve.

All therapeutic measures act as two-edged swords, and only those are permitted to employ them who are familiar with their uses and acquainted with their dangers. Those drugs which are most beneficial when properly used and give the most satisfactory results when employed by physicians, become deadly poisons and extremely inimical to life in the hands of a layman. If amusements are to be used as a therapeutic measure, the method of their employment must receive professional study and consideration, and the time of administration, the mode of application, the quantity, the quality, and the physiological effect produced must be reduced to some sort of a science. Not only must the nature of the recreation be known to its remotest elements, but the patients must be studied and closely observed during its administration. The man in charge of this part of the work should not only be an observing physician, but he should take no part in the performance himself. His place is among the patients, studying the psychical and physiological effects. In no other way can amusements be scientifically adapted to the needs of patients. To depend for your knowledge of results upon the reports of a half dozen or more patients who always go into ecstacies, regardless of the nature of the entertainment, is to be led astray. The effects of any therapeutic measure, whether amusements or drugs, can only be learned from professional observation **at the time of administration.**

In some hospitals the management of the amusements is put into the hands of anybody, experienced or otherwise, who possesses the knack of "getting up" things, though they would be slow to engage a man as a pharmacist who knew nothing of the physiological effects of the drugs he handled but who was handy at pouring the contents of one bottle into another, or who could "get up" some very pleasing drug combinations though grossly ignorant of what the result would be upon the patient who was obliged to swallow them. If this manager is proficient as an actor, there will be plays; if as a musician, there will be music; if as something else, then there will be something else, but all the time the medicament will depend alone and altogether upon the special field in which he is proficient, regardless of the physiological effect upon the patient; just as if a pharmacist, who was an adept in preparing a solution of quinine should insist, and the hospital management agree, that all patients should take quinine exclusively, not because quinine was what they most needed or desired, but simply because the pharmacist was peculiarly proficient in this direction. If the adminstration of drugs received no more professional care or consideration than does the employment of amusements in some hospitals, medical treatment would be no more effective therapeutically than many entertainments.

In a few hospitals for insane, amusements, especially music, have been highly extolled. One superintendent, who has given some actual scientific study and attention to the matter, cannot say enough for the benefits derived from music employed in this way; while another superintendent will pooh, pooh, the whole thing, saying that he tried it once and it did no good. One made it a matter of thought and investigation· the other carelessly and thoughtlessly and, I may say, ignorantly, threw it at the patients regardless of consequences. It may be laid down as an incontrovertible fact that when a therapeutic principle produces good results in the hands of one, and poor results in the hands of another, it all lies in the manner and intelligence employed in its application, and amusements must either be regarded as a therapeutic principle and intelligently employed, or be entirely discarded once for all. If they are meant simply to please, without the patient receiving any material psychical or physiological benefit, then they are a useless expense and trouble and should be dispensed with altogether. If, on the other hand, they are a therapeutic advantage, then no pains should be spared to employ and use them in an intelligent and scientific manner. There can be no half-way ground. A man endeavoring to use strychnine so that it will neither be a tonic or a poison may as well cease giving it altogether. Strychnine is meant to be, and by its very nature is, a tonic or a convulsant. If you want neither effect it is useless to give it at all. Entertainments in hospitals for insane are either beneficial or injurious, and if we neither expect the one, nor desire the other, it is useless to continue. Patients in these hospitals are there to be treated, not simply to be amused, unless this amusement is so intelligently applied that it becomes but the sugar-coated capsule within which the therapeutic benefit is conveyed.

In the giving of entertainments, as in the giving of anything else, there is a right way and a wrong way. Patients do not always need a tonic, or, if they do, they do not always need the same tonic, nor in the same dose, nor at the same intervals of time; and in the matter of amusements, from a scientific standpoint, there are some therapeutic features which may well be considered.

In the first place, if anything of a therapeutic value is to be derived from amusements the quality of the latter must be of the best. Nothing "just as good" will suffice. If amusements are to be regarded from a scientific point of view they must be subjected to the same tests and must comply with the same requirements as other medicament. It is useless to expect, nay, it is impossible, to get the same therapeutic effects from poor entertainments as from good ones, any more than you can get the same therapeutic effect from drugs regardless of quality. A band, or an orchestra, can produce good music, or poor music, or a combination of discords and shrieking dissonance which is neither, just as a strychnine tablet may contain the proper amount of that drug, or only an infinitesimal quantity of questionable quality, or a something which is neither, and the therapeutic effect must suffer from a poor quality of music just as it would from a poor quality of strychnine tablet. There is music which charms the savage breast, and, at the same time, there is music that would justify the savage in tomahawking the performer. Until hospitals are as particular about the quality of their music as they are about the quality of their drugs, let us hear no more about the questionable therapeutic value of music, for how can we speak authoritatively about the therapeutic value of music or anything else until we employ a moderate amount, at least, of intelligence and discretion in its administration?

Where there is a piano on the wards an expert and finished pianist can charm and soothe every patient within hearing for an unlimited length of time, but let the same piano be attacked by a patient or employe who has little knowledge of music and no discretion, and in thirty minutes everybody is distracted; in an hour they are frantic; and in two hours, unless some one comes to their relief, all the results of medical treatment for a month past can be undone. I know of nothing so trying to the temper or so demoralizing generally as the pounding of a piano hour after hour by an amateur. In public places one can retire, but locked in a ward with such a combination of torture is a most terrible calamity, and the knowledge that all avenues of escape are closed only adds to the iniquity of the offense. I verily believe that every piano on the wards should be locked, and opened only by permission of the physician or superintendent. What does it matter if the individual, be she patient or otherwise, is pleased and entertained by her own performance if any others on the hall are suffering a corresponding agony?

I know of no more active agent in mental therapeutics than music, just as I can recall no better general tonic than strychnine, but both must be administered with some judgment. Amusements, like drugs, must be of unquestionable quality, not as good as can be done under the circumstances, but the **best**, if any therapeutic benefit is to follow. If no therapeutic benefit **is** to follow, then amusements in any form are a useless expenditure of time and money. In other words, have the best quality of amusements or have none. At the same time, if amusements, even of the best quality, are to be therapeutically beneficial they must be administered scientifically and with proper professional knowledge and discretion.

It may be true that patients are not very discriminating along musical lines, few **sane** people are, but, although they may be unable to trace the motif in a Wagnerian overture, they know whether the effect of the music is one of comfort or otherwise. It is not necessary for a band or orchestra in an institution to play the most classical music; simple selections having a single, pleasing, recurring theme and filled with harmony are better. It is not so much, however, a question of classical complications, or of melodious simplicity; **it is a question of rendition.** Simple melodies well-rendered are of vastly more therapeutic value than a difficult, technical selection drawn and quartered in cold blood. Patients may not know one tune from another, just as they may not know one drug from another, but they involuntarily respond to each for good or evil, and a certain class of music is not to be prescribed simply because patients like it any more than the particular medicine a patient likes is to be given in every instance simply because he likes it. It is a question of physiological effects in both cases.

A man may know nothing of carbohydrates, or proteids, or hydrocarbons, but, nevertheless, improper food will disagree with him as readily, and the resulting indigestion be as acute, as though he was proficient in the physiology of digestion, and knew all that was to be known about the chemistry of food. Because a patient does not know an arpeggio from a dominant seventh, or a tonic from a subsemitonium modi, is no assurance that he is impregnable against the evil effects of improper music. It is not a question of chemical knowledge in one case or of musical culture in the other, it is simply a question of effect.

Every human being responds to rhythm and harmony. Physiological rhythm and harmony mean health. Loss of organic harmony and rhythm is disorder and disease. The rhythmic beating of the heart; the rhythmic undulations of the intestines; the rhythmic movement of the lungs; the rhythmic action of nervous impulse; all testify that man in health is a creature of harmony and rhythm. In disease the rhythmic beating of the heart becomes a palpitation; the rhythmic undulations of the intestines becomes diarrhoea or constipation; the rhythmic movement of the lungs becomes apnoea or dyspnoea; the rhythmic nervous impulse becomes erratic or explosive. In the brain the same rhythm and harmony spell health. No organ of the body is so susceptible to rhythmic influences as the brain. Its every movement is a rhythmic one. It has its rhythmic periods of active labor and of restful sleep. No other organ in the body sleeps. It rhythmically expands and contracts with every beat of the heart. Each brain cell with outstretching arms touches the outstretched arms of other cells when in action, and again retract when the impulse has passed, and thus in rhythmical contact and retraction they tick off the psychical moments of consciousness. Indeed, consciousness itself is but a constant and rhythmical succession of conscious states. Disturb this rhythmical succession, and unconsciousness supervenes. Disturb the rhythmical contact and retraction of the dendrites and axis cylinders, and disorders of intellect arise. Disturb the rhythmical flow of brain activity and sleep, and the whole man suffers.

If music has any therapeutic value in abnormal mental states it is in its influence toward the re-establishment of mental rhythm. The vibrations in one violin string will generate vibrations in other strings tuned in harmony. By variations of the pitch of the original string all conditions of harmony in other strings may be met, and I know of nothing better calculated to re-establish rhythm and harmony in the mind, where there is any possibility of re-establishment, than the rhythm and harmony of music, if the latter can be intelligently adapted to the conditions to be met, and can thus sound and beat in unison with the mental impulse which still retains its strength but has lost its rhythm.

It is for this reason that the particular kind of music best relished by the patient should not always be supplied. The natural tendency of the mind is to derive the most sensuous pleasure from the tone most nearly in unison with its own, and in abnormal mental conditions the abnormal tone and rhythm is most agreeably affected by a corresponding musical tone and rhythm. Consequently, the music most agreeable to the patient is not always the most beneficial. The therapeutic object of music is not to cater to abnormal mental pitch and intensity, but to encourage normal rhythm and intensity by a wholesome and harmonious combination of musical tones. Doleful and dirge-like music may strike a perfect chord with the mental pitch and tone of the melancholiac, but the striking of a perfect chord with the mental state of morbid depression, instead of being beneficial, is injurious, for it only amplifies and strengthens the intensity of the abnormal condition; and the same, reversely, is true of states of mental excitement. If any and all kinds of music are given indiscriminately and indifferently to every and all kinds of patients, that failure results is no argument that there resides no therapeutic value in music. Drugs given in the same way would meet with similar results.

Whether music is classical or not is unimportant. Its value lies in its perfect harmony and rhythm, and its power to incite a similar and healthful response in the individual by the intelligent adaptation of the means to the desired end.

To be good, alone, is not enough. **Amusements must be varied in their nature.** They must not be all music, or all plays, or all socials, or all any other one thing. There must be variety, not only a variety and change of the usual enterainments, but new, unusual and unfamiliar entertainments must be frequently introduced. Plays and concerts and dances have done duty steadily and uninterruptedly in some institutions for lo, these many years. These are not enough, other amusements must be provided, and even when the old forms are used they must be brightened up and enlivened, and, indeed, often completely transformed by the introduction of some unique or unexpected feature.

A general tonic is frequently employed in the treatment of the insane with excellent results, but the best of tonics becomes valueless in the course of time. Instead of persevering in the use of the same tonic, occasional changes to other tonics of the same class works wonders, but there are hospitals, possibly, especially where the tray system is in vogue, where the patient's name will be affixed to a medicine glass calling for some tonic or other medicine and who will receive the same drug regularly and steadily for the next five years, oftentimes long after the physician who prescribed it has departed; and there are, likewise, some hospitals where a dance and a concert, and a dance and a concert follow each other in one long and, apparently, ceaseless round. A tonic administered as unintelligently as this is no tonic at best, and may be harmful even; and entertainments administered with so little discretion as this are not entertaining at best, and may even be a bore.

It is a scientific medical fact that the body establishes a condition of toleration to the most powerful drugs when used too long, and the mind just as surely establishes a toleration to any musical influence when the latter is supplied with the precision and regularity of a staple article of food, rather than as a medicine to be given as required at infrequent intervals. No class of people respond so easily and so quickly to new and original recreative treatment as do the insane, and none so quickly become apathetic and indifferent as a result of frequent repetitions as do they.

Even the best and most enjoyable entertainments pall and lose their effect if, on each occurrence, it is but a fac simile of former efforts. A social presents many interesting features, but, no matter how interesting they may be, they soon begin to drag if each begins at the same hour, and ends at the same hour, and every intervening moment of time is occupied in identically the same manner as the corresponding moment in previous socials. Some new features must be added at each social, and it is surprising how some little diversion will change the whole complexion of the evening. Patients, and others, will speak of what a delightful social it was, never dreaming that the little, even trivial, addition made all the difference between a couple of hours of more or less automatic endurance and an evening well spent.

The regular holiday masquerade balls also lose interest unless something novel and unusual is introduced. On these occasions drills, booths for various purposes, street fairs, carnival and other features may be provided, **but the same idea should never be repeated.** To supply a constant and never-failing stream of new ideas is no easy matter, but it is only in this way that any therapeutic benefit can be derived from entertainments of this nature.

In this institution, from an amusement standpoint, "history never repeats itself." It is an unwritten law that, aside from the regular Saturday night dance, no two entertainments are ever to be exactly alike; something must be added, something must be changed, some feature must be varied. Trying to interest patients by repeating entertainments is like trying to vaccinate a patient who has already had the smallpox. It won't take.

There are, however, other points to be considered. Besides being of the best quality, and varied in their nature, **amusments must be unexpected in the order of their appearance.** So far as patients are concerned, to establish an entertainment as a regular feature occurring at stated and unvarying intervals is to rob it of all therapeutic value. It is true there is such a thing as the pleasure of anticipation but patients derive no therapeutic benefit from pleasure alone. Indeed, pleasure, to many patients, is often an injury unless accompanied by something besides mere sensual gratification. To leave a melancholiac absolutely alone would be to him a source of the greatest pleasure, if pleasure is only the pleasing of the individual. It is not pleasure the patient needs; what he requires is to be surprised out of himself, and this can only come from the unexpected. The introduction of an entirely new and interesting feature at a regular dance will make the evening an event in the patient's life, not because the feature is necessarily so striking in itself, but simply and solely because of its unexpectedness; and the benefit resulting to the patient psychically is that he is mentally aroused by an unlooked for occurrence.

In hospitals for insane, patients are very much creatures of habit. The onlookers at a dance, after coming a few times regularly, will gaze upon the whole performance as stolidly and as indifferently as though every waking hour had been spent in this form of amusement since the previous Saturday night performance, and the effect is, if not injurious, at least inert; but let something new occur, either from accident or design, and see the result. Amusements that strike with the hour, or occur with the monotonous regularity of a given day, are of no benefit, unless the bodily exercise derived by the actual participants in the dance can be said to be beneficial. There is little or no mental therapeutics involved in the regular dances after the first two or three months of the season for, then, even the most sanguine of participants lose interest and it becomes "stale, flat, and unprofitable."

Patients cannot but react unfavorably to this dismal, paralyzing monotony of the always expected. But why, it may be asked, if amusements are employed for their therapeutic influence on the mental condition of patients, why persist in their continuance long after the patients have lost their interest? If the benefits arising from the dances consist in anything more than physical exercise it is difficult to see what good can come from prolonging them when the interest has waned and the exercise as well becomes forced. In this event they should either cease entirely, or be rejuvenated by the infusion of new ideas.

The unexpected is the key that unlocks the doors of apathy and indifference. The order of events for each season should be unknown save to the superintendent and the director of amusements, and the nature of each particular entertainment should remain unannounced until it becomes necessary to do so for reasons pertaining to the needful preparations. When this plan is adopted interest is on the **qui vive**. "I wonder what we'll have this time" is the condition of mind tending toward a mental awakening. Many special features need not be divulged to anyone. To have patients all through the wards discussing a coming event **in all its details** with full particulars of what progress is being made each day in the preparations and what is to be done at this moment and what at another moment, is calculated to take the edge off of the entertainment and in many instances to spoil it. Patients need to be thrilled; to be roused up mentally; to be surprised; and nothing does this but the unexpected.

Three years ago we adopted the plan of having the orchestra play on the wards every other night, but it only required two or three months' trial to prove it a flat failure. It got to be expected as a regular thing, and at that very moment its usefulness was lost. Now, no one knows when the orchestra will play on the wards or anywhere else. The matter is in the hands of the superintendent and the director of amusements only, and it does not play anywhere **regularly**; it plays where and when it is needed, exactly as a physician prescribes medicine, and its appearance is always a surprise. Just how much more patients enjoy an unexpected orchestral visit than they do a regular "cut and dried" one can never be fully appreciated until tried.

Frequent and regular repetitions of a good thing may be all right with some affairs but it has no medicinal value beyond a certain point. A dose of castor oil is given with a definite therapeutic object, in view and, when properly administered, it certainly is a good thing; but because it does its work remarkably well is no reason for immediately repeating the dose. Indeed, the more efficiently it accomplishes its object the less need exists for a hasty repetition. The "good thing" quality of the castor oil is not to be considered, and the physician repeats it, if he repeats it at all, only when the patient needs it. If amusements are to be regarded as a therapeutic measure they must receive the same consideration, and their frequency and character must bear some relation to the needs of the patients.

A large and efficient band should not be taken as an indication that patients need music every night, any more than we should double the dose of all medicines upon the receipt of a new and increased supply; nor does a small band imply that patients do not need music more than once a month. The professional eye must be kept upon the patient and his needs, and not upon the band or other form of amusement.

I am somewhat doubtful about the therapeutic value of plays given by hospital employes. I would in no way criticize their quality, for I have seen plays rendered by this home talent in a manner quite creditable to professional actors but, in spite of all this, we know that there is a something missing from these home plays which no amount of local talent and good acting will supply. What is missing is this element of the unexpected. The employes taking part in these plays are known to the patients. Any patient intelligent enough to appreciate a play has no difficulty in discovering the identity of the actor beneath any sort of disguise. As soon as this discovery is made there is little to be hoped for from the effect of the unexpected. Indeed, the glamor and mystery surrounding the hero, or the righteous indignation felt toward the villain, or the sympathy due the lady in distress, are impossibilities for the patient who knows that this same hero, or villain, or lady in distress is the attendant on his own ward, or the ward adjoining, and whom he applauds out of loyalty, but from no actual feeling born of a belief in the reality of the situation. Patients, as well as employes, applaud a clever bit of acting but they are never lost in the sweep and onrush of dramatic action; it is always acting to them and not the real thing. It is frequently a subject of remark that patients brighten up so quickly and laugh so heartily and spontaneously if an actor trips over a rug accidentally or falls off a chair, even with evident design, for such occurrences are about the only unexpected features of the play.

When a patient recognizes his attendant or ward physician as one of the players, he subsequently sees nothing but the said attendant or physician walking through the play, and, whether he is making love, or plotting evil, or is shot in the discharge of his duty, matters little to the patient. It is not real, there is nothing unexpected, there is no thrill of uncertainty, there is nothing unknown, there is no mystery. There is nothing calculated to lift the patient out of himself during supreme moments or at dramatic climaxes, nor to drag him away from his self-consciousness and morbidity by blotting out both the past and the present; by making him forget where he is or what he is; by causing him to unconsciously respond to every dramatic episode. If the patient is sufficiently intelligent he can make due allowances for the actors and appreciate wherein they closely imitated the character they assumed, but this critical state of mind is of no therapeutic value. Many others, unable to enter so heartily into the spirit of the situation, experience a sense of dissatisfaction and a feeling that they have in some way been imposed upon and deceived.

I have often been impressed with the fact that plays rendered no better and, possibly, in some instances not so well, by strangers are much more impressive and of more lasting benefit. In drills, in dances, in special marches, in concerts, in masquerades and in a long list of other special features employes are just as efficacious as strangers, because there is here no attempt to make things other than they are and the patients receive the performance without considering the performer; but in plays, if the performer is not completely lost and submerged in the character assumed, the illusion is destroyed and the effect is lost. Home plays are not objectionable, but I do not believe they possess any therapeutic value.

The unexpected, in the way of amusements, is the magic wand that opens the way to the therapeutic treatment of mental states. It stirs

the patient out of himself; it arouses and attracts, momentarily at least, the most sluggish attention; it opens up new paths of conduction or finds its way through old ones long since grass-grown and choked with weeds; it does more to untrammel the mind and induce it to shake off its apathy than any drug in the pharmacopoeia; it is the one thing needful in the treatment of mental conditions. Whether or not amusements shall be regarded as a therapeutic measure will depend altogether upon the manner of their employment. When properly employed I believe them to be as necessary and as efficient as drugs; not that they take the place of drugs, but they constitute an adjuvant not to be despised. In fact, if the usual hospital drug bill was cut in half and the amusement fund doubled, I think I can see better and more lasting results to patients, but this doubling of the amusement fund must be used for the purpose of enlisting scientific and therapeutic intelligence in the interest of the amusements rather than in increasing the number of amusements themselves. There is sufficient money spent for amusements; what is needed is the scientific application of the amusements we already have to the needs of the patient, and this can only come from a more intelligent study of the situation than it has yet received.

WHAT CAN BE DONE IN THE WAY OF PREVENTION OF TUBERCULOSIS BY ORGANIZATION.

By E. Luther Stevens, M. D., Des Moines, Iowa.

There are two leading objects held in the mind by those interested in the anti-tuberculosis crusade in Iowa. The first is educative and includes the instruction of the people regarding the cause and prevalence of the disease, the methods by and conditions under which it spreads, the methods by which it may be prevented, and the methods of treatment of patients afflicted with the disease. The second is the stimulation of the public to such an extent that they will go down into their pockets for the funds necessary to properly treat those now afflicted with the disease and prevent further infection, so that we may (quoting Dr. John H. Prior from memory) "take care of them at the right time and in the right way until they are well instead of at the wrong time and in the wrong way until they are dead."

Before constructive educational work can be done, the public must unlearn some things and if this can be done without too much upsetting it will be fortunate. That consumption is hereditary, that

climate affords the only cure, that it is almost invariably fatal are erroneous ideas that are firmly fixed in the minds of the people and like all popular opinions each has some foundation in truth.

The belief in heredity is due to the very common occurrence of the disease in a family during successive generations, the more important fact of the infected environment or the direct infection of one member of the family through the intimate association with the consumptive member being overlooked. Granted (for argument's sake only) that consumption is hereditary, environment is a thousand times more important as a factor in spreading tuberculosis than heredity.

The unfortunate prevalent idea that climate affords the only cure is due to the fact that preceding generations of medical men have invariably recommended a change of climate for their consumptive patients, the benefit usually derived being accredited to the change of climate rather than to the change of environment, the lessening of opportunity for infection. and rest from their regular vocations.

A re-adjustment of the popular views regarding the mortality of tuberculosis is not so difficult if one considers the fact that heretofore but few cases of consumption have been recognized in the early stages. When the disease has progressed so far that "he who runs may read", it is usually fatal—just as much so now as it ever was and to this extent the popular idea of the mortality is correct. But since physicians have learned to detect the disease early in its occurrence, it has been demonstrated beyond all possibility of reasonable doubt that the disease is curable. It is a fortunate combination of circumstances that the treatment which makes the disease curable also prevents its extension.

Some one has well said that the facts of medicine well-known to physicians of one generation become the common property of the people in the succeeding generation. The present generation of medical men are teaching in a very positive way:

(1) That tuberculosis is a disease due to a recognized germ;

(2) That this germ thrives and produces its effect upon the human organism under all those conditions which weaken the body, particularly insufficient food, faulty ventilation, overfatigue, chronic weakening diseases, acute infectious diseases, and alcoholism;

(3) On the contrary, that this germ can not thrive nor produce its effect upon the otherwise healthy human body which is well-nourished, well-cared for, and abundantly supplied with sunshine and fresh air;

(4) That tuberculosis is a preventable disease—preventable by altering the conditions in such a way that the germ can not thrive, by methods which are destructive to the germ or that increase the blood supply and nutrition, thus aiding the resisting power of the human body;

(The methods of prevention are not only of service in protecting individuals from infection, but if used sufficiently early will cause the arrest of the disease in a fresh victim.)

(5) Tuberculosis in its early stages is curable. This statement is a surprising one to the public. Technically speaking, the phrase "the disease may be arrested" should be used, but so far as the public is concerned and so far as all the clinical signs of the disease are concerned, under proper conditions it is curable.

(6) The disease is terribly prevalent:

(a) Two thousand Iowa people are dying every year of tuberculosis;

(b) More than ten thousand Iowans are sacrifices to the disease in the first five years of this new century;

(c) Seven thousand Iowans are now afflicted;

(d) More than five thousand of these are between the ages of twenty and fifty;

(e) More than five hundred are students and teachers;

(f) More than two thousand are young men and women;

(g) But the saddest fact of all is that each one dying of this disease infects four others, one of the four being fatally infected. And here let us remark, parenthetically, that there are forty-three other states with worse records than Iowa.

> "Who being man . . . can stand calmly by
> And view these things, and never tease his soul
> For some great cure? No physic for this grief,
> In all the earth and heavens too?
> . . . .
> To see it down in figures on a page,
> Plain, silent, clear, as God sees through the earth
> The sense of all the graves,—that's terrible
> For one who is not God, and cannot right
> The wrong he looks on. May I choose indeed,
> But vow away my years, my means, my aims,
> Among the helpers, ...
> . . . . The common blood
> That swings along my veins is strong enough
> To draw me to this duty."

That the truths which medical science is teaching regarding tuberculosis, and its tremendous ravages as shown in the above figures, may be brought to the attention of the people in the quickest way possible, we suggest the following plans which we believe to be practical:

We should have one central organization to be known, possibly, as "The Anti-tuberculosis League", with committees in every county, township, city, and ward. The primary work of these committees would be educational and should:

(1) Work in hearty co-operation with health officers, county and city officials, local medical societies, clergymen, and particularly public school boards;

(2) Gather detailed information regarding the prevalence of the disease and the location of the victims and should know that every case occurring in their respective localities is cared for in such a way that there be no chance for infection of other individuals;

(3) Distribute proper literature as sent out from the central organization;

(4) Keep the public press supplied with reliable information on the subject;

(5) Secure the interest of well to do people to such an extent that they will make liberal donations or bequests for carrying on the crusade;

(6) Provide for stereopticon lectures in churches, lodges, county teachers' institutes, farmers' institutes, etc.;

(7) Arrange for exhibition at state and county fairs and at the various high schools, colleges, and universities.

Through these many ways this central organization should do all in its power to mold public sentiment into such a practical form that the next General Assembly will recognize it and make liberal provision for the carrying on of this great work.

A further duty of the central organization would be to stimulate an organized effort in the larger centers of population in the state to establish and maintain organizations or institutions for the treatment of cases of tuberculosis in whatsoever stages or conditions so that each patient be managed in such a way as to prevent reinfection of himself or the infection of his friends or his surroundings. Such cases will require proper methods and suitable places for the various classes of patients.

(1) For the curative treatment of incipient cases an institution must me provided where they may be cared for until they are well or until they have learned how to safely care for themselves. Such a place should be an institution properly located where those cases which can leave their homes may stay from three months to a year.

(2) For those incipient cases which for any reason can not leave their homes, dispensaries should be provided where they can be kept under observation and treatment and be taught all that is possible about caring for themselves, the home life being under the careful supervision of a physician or a specially trained nurse. Such dispensaries may serve as a sort of information headquarters for their re-

spective communities and for the examination of all suspected cases which are unable to pay.

(3) For the incurable cases a different place should be established where they can be properly nourished and kept as comfortable as possible. Two nurses can look after several bedfast cases in an institution at practically the same expense incurred in caring for one at home. (It would seem wise, though so far we know it has not been tried, that dwelling houses be used temporarily for such cases and after being used for a time could be thoroughly disinfected and other houses chosen. This would avoid the gloom which would settle inevitably upon an institution having the unfortunate name and object of "A home for Incurables".)

(4) For incurable patients who can not be or do not desire to be admitted to such an institution, visiting nurses ought to be assigned so that the most careful watch may be kept over the patient to see that he does not infect his surroundings and those with whom he comes in contact. It can not be too strongly emphasized that every patient, whether he be in an institution or not, must be under the most constant observation possible of his physician, a health officer, or a competent nurse, that all the details of preventive treatment may be carefully watched.

Just a suggestion regarding the raising of funds for the carrying on of this crusade: There are so many well to do families in every community which have lost one or more members by this disease that their practical, pocketbook sympathies may be easily reached, their humanity leading them to make efforts to prevent others suffering likewise. By looking the records of deaths for the past few years, these families can be ascertained. To men of affairs, the economic waste of letting this disease go on unchecked may be easily demonstrated. The judicial value of human life in this State having been estimated at $5,000, the actual loss from the two thousand deaths would be $10,0000,000; but this is only a portion of the loss. Five thousand who are now afflicted are at the wage-earning age. The larger porportion of victims die just as wage-earning capacity is reached, or in the very prime of life or earning ability. The duration of the disease in the patient, as averages go, is three years. The first year he may earn the larger part of his salary; the second year his earning capacity is cut in two or ceases entirely; the third year his earning ability has not only ceased but he requires the constant attention of some member of his family and a part of the time two or more other persons.

Would it not seem that with such active measures, could they be carried out in completeness, that the work of this organization and these committees would be done? Happy would we be could we think so, but the facts are that such work would be only a beginning, for while it would be curative and preventive, it would be only partially preventive until the people of our great state learn how to live under right hygienic conditions. The only thing the good Lord has given us for which He does not exact prompt pay is fresh air and through some sort of mental twist we seem to have lost connection with this central thought and have got to return to it and learn to open our doors and windows, particularly those of our living and sleeping rooms, and let the pure air of heaven fill our cramped, delapidated, atrophied lungs.

This gospel of right living and the various epistles of Hygeia to our benighted people (benighted in this sense, for it is not because of our ignorance but because of lack of information on this one subject) must be carried with rapidity directly to the people. When the people appreciate these messags, our streets and alleys as well as our cellars will be cleaned up, the dust-laden air of our cities will not have to be handled with a shovel, and the respiratory catarrhal diseases will deminish rapidly in frequency and severity.

The proper treatment of every patient afflicted with tuberculosis is far-reaching in its influence for it not only arrests the disease in incipient stages or relieves in the incurable stages but it prevents the spread of it, educating not only the patient but his family and the community from which he comes and to which he goes.

The lessons learned in dealing with this preventable, infectious disease and the teachings of hygienic living thereby inculcated are applicable to the prevention of other infectious diseases, so that the sum total of human misery will be greatly lessened and the average span of human life lengthened. But the benefits are even more extensive than those mentioned, for the increased health and happiness will encourage us to open wide the windows of our minds and souls that the truth-light may penetrate their darkest recesses and we will become nearer like that which we were planned to be—"in the image of God created he him".

A MORPHOLOGICAL CONTINUITY OF GERM-CELLS AS THE BASIS OF HEREDITY AND VARIATION.

Reprint with sundry alterations and corrections, of a paper published in the Review of Neurology and Psychiatry, Vol. 2, Edinburgh, 1904.

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"Die Folgerungen aus dieser Lehre von der Continuitaet der Geschlechtszellern sind fast unabsehrbar fur die gesamte Biologie."—W. Waldeyer.

PREFACE.

In the following pages it is proposed to give an account of observations and conclusions, relating to what in their origin, at any rate, were purely embryological problems. The researches, commenced in the autumn of 1888, have now extended over more than fifteen years, and they were undertaken, and for many years continued, solely with a view of determining by observation the apparently simple question of the mode of development of a vertebrate animal. They had not proceeded very far before it came to be recognized that whether or not a "direct development"* was possible, that presently carried out in the higher animals had every appearance of being anything but direct; indeed of being based in an antithetic alternation of generations.† This was of such a kind that the fertilised egg gave rise to an asexual foundation or larva, termed by me the phorozoon or bearing-animal, and that in some way or other upon the latter there arose an organism, termed the embryo, which by reason of its endownment with sexual organs may be described as the sexual form or generation.

To the writer the truth of this was convincing enough more than ten years ago, but at that time the state of the investigations was not such as to win over other scientific workers—with a single exception!—to the opinion that there was the slightest reason for doubting any of the fundamental tenets of embryology then current. But now it is quite certain that the phorozoon and alternation of generations have come to make a permanent stay with the science of embryology, and that its votaries can as little dispense with them as can Nature in her workings.

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* Under the still prevailing view of "direct development" the hen, for example, produces from the tissues of her body new eggs, while it is the immediate task of the fertilised egg to give rise to a new hen. In these few simple words were contained, as will be seen anon, three of the most serious errors, epigenesis, direct development, and somatic origin of germ-cells, into which it was ever the misfortune of any branch of science to fall.

† A botonical term. Where in a life-cycle there are two organisms differing in their organs and in their total organisation, and when there is thus no homology between them or their parts, the alternation of generations is said to be "antithetic."

Since the standpoint was attained more than ten years ago, no facts adverse to it have been encountered. From them till now the course of research has proceeded straight as an arrow to the climax. The rebuffs, which have had to be faced and borne, have not come from the investigation itself: it has been quite free from check, except that which at any time lack of material may impose upon the worker. The doctrine has never been seriously attacked: in all these years it has simply been ignored. It is rapidly gaining supporters now, but for long it did not win many—the truth never does at first! For myself I have been content to follow out the inquiry, and from time to time, as opportunity offered, to glean a few more facts supporting this theory of development. During part of this period a watch was kept for something equivalent to the formation of spore-mother-cells in the higher plants or Metaphyta, but in vain. In the earlier years, as at length apparent, the search had not been made in the right place.

The investigator is often the creature of circumstances. These in the present case brought about a research into the early history of the germ-cells without at the start associating with this inquiry any ideas concerning spore-mother-cell-formation or alternation of generations. Only when this work had reached a preliminary finish, and when the results had been drawn up in diagrammatic form for purposes of publication, did the full force of the facts discovered become evident.

As now fully recognized, the more recent portion of the work—that upon the germ-cells and their problems—is in absolute necessity for the formulation of any clear and scientific conception of the nature and mode of development of the higher animals. Its results have not only confirmed the conclusions of former years, but they have served very considerably to extend these. The germ-cell researches, including those into the problem of determination of sex, have established antithetic alternation of generations as the mode of the development.

Of the consequences that follow out of the researches it is, perhaps, not too much to say that they are immeasurable. Looking back now at the starting-point, it must be admitted that the track has been long and lonely. The lonesomeness of research along a new and untrodden field is, indeed, as the solitude of the pathless desert!

Among the pioneers in this region the name of Waldeyer is, perhaps, the most prominent, and there is a fitness in prefacing the present writing with a passage quite recently written by the veteran observer. As will appear in the sequel, the proof of a morphological continuity of germ-cells from generation to generation was first really brought by the writer in his published researches. In them was first really brought by the writer in his published researches. In them was afforded for the first time the possibility of following in a distinct and tangible form, and without the assumption of the continuity of an hypothetical intangible germplasm (Weismann), the track of germinal continuity from one generation to the next. Waldeyer writes: "The consequences of this doctrine of the morphological continuity of sexual cells are almost unbounded for every branch of biology." No earnest investigator can ignore the immense, the overwhelming importance, of this continuity for the science of embryology. It and the various facts associated with it are bound sooner or later to revolutionise completely the ideas and conceptions of zoologists, anatomists, and embryologists. They will relegate the dogmas of epigenesis and direct development to the list—a pretty long one already—of former erroneous doctrines of science, and they will open up new and important pathways of research and knowledge, of which at the moment no conception whatever can be formed. In other directions the doctrine and its allied facts will doubtless prove themselves to be equally fruitful of results. Without the least doubt they form the basis of that portion of pathology treating of the tumours,, benign and malignant, and the writer is informed that their bearings upon the problems of insanity are simply incalculable. It is this assurance that accounts for, and may excuse, the appearance of an embryological document in the pages of this journal.

INTRODUCTION.

The main object in view in the following pages are the problems of heredity and variation, and the light thrown upon these by the results of a study of the life-cycle of development and of the important part played by the germ-cells in this. It is out of question, it is, perhaps, not needful, to give an account in detail of all the researches, or of the work of other observers, whose results may be required for the elucidation of some point or other. The present writing, therefore, will be little more than an epitome of results and conclusions, and for fuller information reference must be made to the original memoirs.

The problem of heredity is almost the greatest one in embryological science[*] Owing mainly to the writings of Brooks, de Vries, O. Hertwig, Naegeli, Herbert Spencer, and above all others, Galton and Weismann, heredity and its problems have occupied a prominent position in the discussions of recent years. The progress of research into the life-history of the cell, the structure and functions of the nucleus, the phenomena of cell-division, more especially those attending the "ripening" of the "sexual products," have naturally played important parts in these. Indeed, so much has this been the case, that H. F. Osborn might well say the prophetic words, "the study of heredity will ultimately centre around the structure and functions of the germ-cells." This is hardly the place for a full history of these discussions and theories; what is proposed is to indicate the broad and obvious bearings of certain of my results, relating to the history of the germ-cells and the course of the life-cycle, upon the general problems of heredity and variation.

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[*] "These phenomena (of heredity) constitute the basis of all evolutionary science and the very central problem of natural history."—W. Bateson, in "Mende's Principles of Heredity," Cambridge, 1902, p. 1. There is a greater problem, that of the nature of Life, but to all appearance this is forever beyond human grasp and conception.

One may dismiss the older ideas upon the subject, popular and scientific, and take as the starting-point Galton's "stirp" (1875). This was conceived of as something left over from every development, a material basis, from which ultimately the next generation took its origin. In the conception of this "stirp" we have for the first time a recognition, dim and indistinct though it be, of a tangible something, connected in some way with the germ-cells, out of which the phenomena of heredity proceeded. A much larger space in the history of heredity is occupied by Weismann's theory of the germplasm. His doctrines have been elaborated and extended with infinite pains and untiring research during the last twenty years.* In the lectures referred to below, in the English editions of his essays and of his more recent "Lectures,' and in the "Germplasm," published in 1893, full accounts of his views may be found. I have no space here for an adequate statement of them. The whole doctrine is based in an hypothetical germplasm of great complexity and endowed with enormous potentialities. It is not so much in a morphological continuity of germ-cells that Weismann's conclusions are founded, as in a continuity of a germplasm which may even be in somatic cells. More than once he has expressly stated, and certainly he has never retracted it, that "in some cases at any rate," germ-cells may arise from somatic cells. And it is only for the group of the Insecta (1) that a real morphological continuity of germ-cells is admitted by him, while for all other Metazoa or higher animals, the theory advocates the continuity of an hypothetical germplasm alone.

Any theory of heredity to be successful must have its basis in the facts and mode of metazoon development. The great weakness of Weismann's theory of the germplasm is that it is not in accord with the facts of development, and not based in these. And while, on the one hand, since the appearance of my results upon the germ-cells of Raja in preliminary form in 1900, Weismann does not really now deny a morphological continuity of germ-cells—as he previously did when face to face with Nussbaum's conclusion (for which see later)—

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* The first edition of Weismann's address, "Ueber die Vererbung," was published in 1883. While his latest work upon heredity, "Vortwaege ueber Descendenztheorie," in two volumes of some 900 pages, appeared in 1902.

† The references within brackets will be found at the end of divisions III. and XI.

be practically never really admits it*—certainly not in my sense. The existing morphological continuity is replaced by that of an hypothetical substance, the germplasm, whose necessity I cannot recognise. Moreover, as an upholder of the recapitulation-theory and of direct development, Weismann's conception of the course of the development from one generation to the next differs in toto from that which my researches have led me to adopt as the only true and sole possible one.

It has been urged, as, indeed, might have been anticipated, that the writer's conclusions were but slight variations upon the earlier ones of Wiesmann. But as, almost the only real resemblances between Weismann's conclusions and mine are our agreement as to the impossibility of epigenesis, and as to the truth of evolution or unfolding. It is, no doubt, quite true that the hypothesis of the germplasm and its continuity offer explanations of any number of things, almost identical with those given under a morphological continuity of germ-cells. Again and again in Weismann's writings were one to substitute the expression "germ-cell or germ-cells" for "germplasm," facts or probabilities would be stated. But everywhere the actual thing named is germplasm, not germ-cell! And quite apart from the difficulties associated with the conception of the germplasm and its continuity, the assumption of its existence is now unnecessary. Moreover, it must not be forgotten that Weismann's views and conclusions admit, and are founded in, direct development in the higher animals, recapitulation in development, and "in some cases at any rate," somatic origin of germ-cells, all of which are under my conclusions emphatically denied.

In order to obtain a clear insight into the process or processes by which, in a wide sense, germinal continuity, resulting in the phenomena of heredity, is brought to pass, it is a requisite postulate that an uninterrupted and continuous panorama of the whole course of development from one generation to the next should be secured. Heredity must be dependent upon some sort of germinal continuity; whether of a special germplasm in Weismann's sense, or a consequence of an uninterrupted sequence of germ-cells, or a result of an intracellular pangenesis, or something else.

In this way it comes to be a problem of embryology and development,. and as such it falls within the province of the embryologist. This being so, is it not remarkable that the chain of germinal continuity should hitherto not have been completely grasped in any single case? From my researches on the germ-cells, it is clear that hiterto no complete survey of the development from one generation to the next has ever really been made. One phenomena in the Metazoan life-cycle has entirely eluded the observation of embryologists; or, if they have noted or recorded it, they have failed to realise its full significance. This is the formation of the primary germ-cells, with the epoch at which these appear upon the scene.

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* Except for the Insecta. But of what value is the admission of this exception? If this be the only group in which there be a real morphological continuity, the assumption of a germplasm may be needed for the explanation of other cases. But if there be reason to believe in the general occurrence of a morphological continuity of germ-cells, the assumption of the existence of a germplasm becomes an unnecessary multiplication of causes, and as such unscientific.

Their very early origin—before any trace of an embryo had been laid down—was long ago recorded in certain cases, among others by Weismann, Buetschli, Grobben, Ritter, Metschnikoff, and O. Hertwig. But these very instances only serve to strengthen my centention, for in them the few (primary) germ-cells—from two to eight in number—were apparently so insignificant that their formation at a particular time seemed to be an incident of no moment; and its discovery, like many other important finds, was passed over, because no estimate could be set upon its value.

I. HISTORICAL CONCERNING THE GERM-CELLS.

The early origin of germ-cells in a few cases, Moina, Cecidomyia, Chironomus, and Sagitta, has been common knowledge for a long time. But from these cases, or, indeed, from the later ones, described by Nussbaum and Eigenmann, none ever dreamt either of setting up a new conception of the course of (Metazoan) development, or —and this is very important—of advocating a morphological continuity of germ-cells from generation to generation. If the germ-cells be not somatic in origin, the mode of development cannot be that assumed—without proof—by investigators for the past hundred years! And, as for a morphological continuity, the most that any zoologist ever ventured is, indeed, represented in the following words of Weismann, written in his latest work (2): "Could we assume that the egg on commencing development at once divided into two cells, of which the one gave rise to the entire body (soma), while from the other only the germ-cells contained within this arose, the matter would be theoretically very simple; we should say that the germplasm of the egg doubled itself, as happens to the nuclear substance in every cell-division, and that this divided into two equal halves," one of which formed the body of the individual, whilst the remainder, its germplasm remaining latent, only manifested activities sufficient to give rise to and to impress its stamp upon certain cells, its products, which become the germ-cells. He proceeds to say that this has as yet only been proved to be the case in the dipterous insects. But even in this instance it may be questioned whether Weismann's account is sufficiently precise. For not even here is there witnessed a division of the egg into two halves, somatic and germinal respectively in destination. In fact, nowhere, so far as is known, does the ancestral or primitive germ-cell arise as early as the first division. And, when Weismann speaks of its origin "after the first couple of divisions." this is merely an euphemism; for, of course, he is well enough aware that the number of the divisions of the fertilised egg, prior to the appearance of the primitive germ-cell, is invariably more than two, and very often four.† That is to say, except in mammals, where apparently it may appear at the third cell-division, almost the earliest period, if not the earliest, is the fifth cleavage phase, as in Cyclops, and possibly Ascaris and Strongylus, and it may appear first at about the tenth division, as in Scyllium and Raja.

In the work under reference, passing from the insects, Weismann proceeds to give an account of the origin of the sexual cells in the Hydrozoa, or hyproid polypes. These marvelous researches, published in 1883, apart from the valuable facts they have added to our knowledge, have unfortunately served to retard it in certain directions. They have been held to have established a somatic origin of germ-cells, and they have been, and still are, used by Weismann to show that for a very prolonged period, even for scores of cell-generations, the "germinal track" of Weismann may lie in somatic cells. The hydroid polype, or colony of such, is an asexual generation, comparable to the sporophyte or flowering plant. Germ-cells arise upon it, just as they do upon a flowering plant, but its cells are not "somatic" in the sense of those of a higher animal, such as a man. From true somatic-cells there is aeru an origin of germ-cells.

In the foregoing passages there are implied two fundamental errors, which have retarded our knowledge of germinal continuity and how this is effected, and which have delayed a recognition of the true course of the life-cycle. It is assumed to be the task of the fertilised egg to give rise straightway to a new "embryo," and the hydroid polype has been—and, mirabile dictu, still is ! ! !—regarded as morphologically the equivalent of the "embryo" or sexual form of any of the higher animals. It has been ignored, that in all the latter, from the worms to man himself, the products of the early cleavage are concerned, not in the formation of an embryo, but an asexual foundation or larva. Regarding the Hydrozoa, it has not been clearly recognised that in origin, mode of growth, and other peculiarities, the hydroid polype corresponds to the sporophyte of plants, that it is not the bearer of sexual products, the forerunners of these arising from certain apical cells, and it has been wrongly believed that the medusa or its equivalent is homologous with the hydroid polype. To prove that in the Hydrozoa germ-cells are somatic in origin, it must be demonstrated that they have their birth from some tissue or other of the sexual generation, the medusa. It need hardly be remarked that Weismann's own researches amply disprove this.

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† Concerning the epoch at which the primitive germ-cell and the primary germ-cells appear in the Diptera, etc., there are no precise statements in the literature, or in Wiesmann's published researches. In no instance would they appear to arise earlier than in Nereis, i.e. with the fifth cleavage. Possibly, though not certainly, in mammals (Tupaia, Tarsius) the primitive germ-cell may be a product of the third cleavage. This appears to be the explanation of Hubrecht's finds of a sac of seven cells with one clear cell in the centre, out of which alone the whole embryo takes its birth, according to Hubrecht.

In 1880 Nussbaum enunciated the conclusion, which he arrived at from the appearance and size of the germ-cells of the embryo frog, that these must be special cells of the egg-cleavage, which at no time took a share in forming the individual, but which were intended for future generations. Unfortunately, he has never by research followed up the matter to its end. I have already elsewhere described this as a "brilliant idea," and as one result of my researches, but one only, I have emphatically endorsed it. A like conclusion was enunciated in 1892 by Eigenmann for a Teleostean fish, Micrometrus, and his work contains many more observations upon the germ-cells than does that of Nussbaum. Thus, he recorded their presence far forward in the embryo, the disappearance of some of them, and their migrations, in addition to surmising that they dated back to the fifth cleavage-phase. Neither of these observers made any attempt to set up by observation a morphological continuity of germ-cells; for with neither did the mode of the development, the true life-cycle, lie within the scope of the observations. When, therefore, Nussbaum* in a recent lecture sets up a morphological continuity of a sort, this is based merely in an incorrect and loose dictum that the segmented egg divides into the somatic cells and the germ-cells. When cleavage is really finished, an epoch which is not the same for all animals, there are no somatic cells present! Neither Nussbaum's view of matters, nor Waldeyer's assumption of the division of the egg into two halves, somatic and germinal respectively, nor even Weismann's most recent statements, afford us any sound and real conception of the actual facts.

It is not sufficient for our purpose to study the first appearance of germ-cells in embryos—by so doing we may conclude their somatic origin, whereas, in reality, they exist prior to the appearance of any trace of a soma. This is a fact of observation, and its existence removes the justification for any and every assumption. It is illogical to conclude that the problem is solved in all its aspects, or in anything like all, when from the sizes and other characters of the earliest germ-cells in embryos we have referred them to the clevage. To trace the whole chain of continuity, to reach the conception of a morphological continuity of germ-cells, we must be able to form an adequate picture to ourselves of all that happens to the products of the egg from the moment of fertilisation until the appearance of a new egg. This was done, and for the first time, in the various results of my investigations, published in the years from 1889 to 1902. And it is these researches, along with the little portions of the life-cycle filled in from the work of others (Boveri, E. B. Wilson, and Semper), which first really established for the Metazoa or higher animals, a morphological continuity of germ-cells. Such a continuity is nowhere shown in the researches of Nussbaum, or Boveri, or Weismann, or in those of any other observer. And how Prof. Waldeyer can believe this to have been the case, I can as little conceive, as I can imagine the continuity of an hypothetical germplasm to be the same thing as an actual morphological continuity of germ-cells.

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* Nussbaum, M., "Die Verebung erworbener Eigenschaften," in Sitzungsber. Niederrhein. Gesell. Bonn, Feb. 16, 1903, loc. cit. p. 2: "Es teilt sich das gefurchte Ei in die somatischen und in die Geschlechtszellen." It would be of interest to learn upon whose observation this statement rested—certainly not upon Nusssbaum's work or mine! !

Indeed, even as Weismann advanced the conception of a germ-plasm, he denied the validity of Nussbaum's conclusion mentioned above—and Nussbaum's idea was undoubtedly in the direction of a morphological continuity—and he decidedly rejected the view "because as a matter of fact the sexual cells of all plants and those of most animals do not separate themselves from the beginning from the somatic cells" (3).

And this is the very question at issue! The statement contains two fallacies, and these rob it of all force. Taking these in the order of their occurrence, the first is, that the sexual cells of all plants do not separate themselves from the beginning from the somatic cells. Probably all the higher plants, the Metaphyta, are here referred to, for in many of the lower plants all the cells might be regarded as potentially reproductive or "sexual." In the higher plants the "sexual cells" do appear at a very early period in the sexual generation. The higher one ascends the earlier is this epoch; for in the flowering plants, for instance, the life-span of the sexual generation, the gametophyte, is exceedingly short, and it is concerned solely with the differentiation of, and the provision for, the sexual cells. These latter certainly do not appear as such in the asexual generation or sporophyte, nor is it to be expected that they should. Were they to do so, and could do so, the sporophyte would lose this character, and become a gametophyte. Moreover, even in the asexual generation, the sporophyte, the morphological continuity is unbroken, for in this the future germ-cells are represented by their direct ancestors, the one or more cells forming the apex.

Of this continuity in plants, Noll eloquently writes as follows: "The vital capacity of the cells of the functioning permanent tissue is always limited in time—mostly, indeed, very closely so. Without limit, on the contrary, and never finding a natural close, the vital power of the embryonic substance is preserved. This it is which forms the growing points of the perennial plants, and from this, as Sachs first demonstrated, the growing points of the sexual progeny are directly derived through the substance of the germ-cells. This embryonic substance does not age; it produces new passing individuals, but it is permanently preserved in their progeny: it is always productive, always growing young and increasing. Thousands upon thousands of generations which have arisen in the course of millions of years were its products, but it lives on, in the youngest generations with the power ot giving origin to coming millions. The individual organism is transient, but its embryonic substance, which produces the mortal tissues, preserves itself imperishable, everlasting, and constant. Regarded from this standpoint, the differences in the duration of life between short and long-lived plants, between annual herbs and the thousands of years old giants of the plant race, appear in another light. Out of the embryonic substance of that lime-tree of Neustad every year new leaves and buds form, but there remain in connection with the dying remains of structures of earlier years. In the annual plant, on the contrary, the embryonic substance separates itself every year in the embryo from the mortal remains, and forming new branches, leaves and roots, becomes a completely new individual. At the basis of the old and well-known dictum of Harvey, 'omne vivum ex ovo,' there thus already lay the continuity of the embryonic substance. This is, at the same time, in eternal youth and organic immortality the substance of the unicellular organisms, which, reproducing by fission, are used up in one another without residue" (4).

What Nussbaum insisted upon was the early appearance of the germ-cells in the sexual generation of animals, i.e. in "the embryo," before this had undergone histological differentiation. In urging this he took up a very moderate attitude. To refute his conclusion from the botanical side, the conditions in the corresponding generations in the two kingdoms must be compared; that is to say, the embryo and the prothallus must be placed together, not the embro and the sporophyte. As to Weismann's second objection, it must be insisted, that even now the early history of the germ-cells of "most animals" has as yet been very inadequately investigated. Where it has been traced back to the farthest possible point, there invariably a very early origin has been made out. This is now so in Moina, Cyclops, Ascaris, Strongylus, Cecidomyia, Chironomus, Sagitta, Phalangium, Lernaea, Micrometrus, Scorpions (Brauer), several insects (Heymons), some sponges (Maas), Cephalopoda (V. Faussek), Pristiurus, Scyllium, and Raja. Until 1900 the apparent phenomena in the Vertebrata stood in the way. Here even a segmental origin of the sexual cells had been recorded in relatively late phases. This, however, though it perhaps has at present more supporters among embryologists than a morphological continuity, is only one of the ever-recurring instances of theearliest observed appearance of a thing being taken to represent its first origin. In embryological research this is only permissible when an earlier origin is absolutely out of question.

From a fair acquaintance with the embryological literature treating of the germ-cells and their origin, the writer must maintain that there is really no reliable evidence whatever pointing to the late appearance of the germ-cells in any single case. On the other hand, there is a steadily accumulating body of very strong testimony in favour of their early separation off in many different divisions of the animal kingdom. Even the case of the hydroid polypes cannot be cited in disproof, for Weismann's own great researches reveal, not so much the origin of the germ-cells in these, as their remarkable migrations.

In raising objections in face of the known facts concerning Moina, the dipterous insects, etc., Weismann defined, not only his own standpoint, as the upholder of an hypothetical germplasm, but also that of most zoologists. Direct development implies, nay assumes, a somatic origin of germ-cells, and under its sway even an odd instance of a morphological continuity can find no place, and the exception meets with no favour until it ceases to be such and adapts itself to the rule. But, as Goethe sagely remarked (5), "die Natur geht ihren Gang, und was uns als Ausnahme erscheint ist in der Regel." And this is so simply because what we regard as the rule is often false, the real law being with which the apparent exception conforms.

While only from two to eight (primary) germ-cells were found very early in the development of this or the other form; while, as in the higher animals, one could study the early development without seeing any germ-cells—their "segmental origin" even being witnessed at later periods—the good old rule, in plain words, the superstition, that the offspring was formed by the union of a small portion of each of its parents, seemed to be the only logical conclusion. Thus it happened that so great an investigator and thinker as Darwin could set up his provisional hypothesis of pangenesis. When in one of the higher animals, the skate, the formation of a whole battalion of germ-cells is found to take place prior to the appearance of any trace of an embryo, a change comes over the scene: the apparent law and its exceptions exchange positions, with the consequent disappearance of the former.

Two primary germ-cells and five hundred and twelve—the latter number being that found in the development of a potentially female skate—are very different figures. In fine, in the life-cycle of the skate the origin of the germ-cells fills in so large a space as to overshadow completely everything else, and the formation of an embryo sinks into the position of being a mere incident in the life-cycle.

How little influence previous researches, treating of an early origin of germ-cells, have had upon embryological opinion, mey be gathered from the following facts:—A morphological continuity of germ-cells is nowhere adopted by Weismann in his writings, even in his latest (1905); indeed, until recently he accepted a somatic origin," at any rate in certain cases;" and until 1903, which witnessed the appearance of Waldeyer's account of the germ-cells in Hertwig's "Handbuch and the new volume of Korschelt und Heider's "Entwickelungsgeschichte," no single one of the current textbooks advocated such a continuity, but one and all accepted Waldeyer's conclusions of 1870, that the germ-cells were modified pleuroperitioneal cells (of the germinal ridges), and, therefore, somatic in origin. Indeed, it is not too much to say, that Waldeyer's conclusions (1870) as to a somatic origin of germ-cells, which he now rejects in favour of a morphological continuity, dominated all embryological opinion until 1903. This was the state of affairs when, early in 1899, the writer began his investigations. In a few cases, Ascaris, Strongylus and Cyclops, the track of germinal continuity had been followed by Boveri, Haecker, Rueckert and Spemann for the first five cleavages of the egg. They had not got beyond this point, for under the erroneous conception of direct development they had assumed the first products of the cleavage to be embryonic in destiny, and in the cases of Ascaris and Strongylus the subsequent development after the formation of the primitive germ-cell was, and still is, unknown. How little claim these researches, important though they be, can have to have demonstrated a morphological continuity of germ-cells is shown by the circumstance that it cannot be stated with any degree of certainty whether the organisms dealt with were merely larval (asexual generations) or true "embryos" of a sexual generation. Our knowledge of the development of Nematodes, which we mainly owe to Maupas, and the analogy of other cases, Nercis, etc., point to the former as the real truth.

II. THE HISTORY OF THE GERM-CELLS IN ELASMOBRANCH FISHES.

The material so far employed in the researches has consisted of the smooth skate (Raja batis), the two dogfishes (Scyllium canicula and Pristiurus melanostomus), some embryos of the spiny dogfish (Acanthias), shicks, etc. The chick, which was the animal employed by Waldeyer and others, is not a favourable object for research upon the germ-cells. It can, however, easily be made out in it that they are not somatic in origin, and that they migrate to their ultimate positions in the germinal ridges or nidus. As yet no attempt has been made to follow out the history of the germ-cells of any mammal, for the technical difficulties in the way or research here are very great. But it cannot for a moment be doubted that, mutatis mutandis, what has been found to hold good for the lower vertebrates will also apply to the higher ones. There is only one mode of development in the higher animals. (Fig. 1 and 2).

On taking an early Elasmobranch embryo, and straining this with certain reagents (osmic acid or Heidenhain's iron-hæmatoxylin), the germ-cells within it are rendered so prominent that one can even count them. These germ-cells are seen to be cells of large size, about 0.02 mm. (Figs. 1 and 2), whereas even the largest somatic cells do not exceed 0.012 to 0.014 mm. Their cytoplasm has a peculiar glassy character, and possesses little or no affinity for any of the ordinary dyes. The nucleus appears to be invariably of the twin or bilobed character, described by Rueckert and Haecker in Cyclops some years ago, and now known to be present in the germ-cells of very many animals—in all those, in fact, in which it has been sought after. Within the cytoplasm for long periods of the development there are yolkplates, of a shape more or less characteristic of each species. These plates are most numerous in the early periods,. their presence is one of the signs, pointing to an origin of the cells from the cleavage, and they are gradually used up as development proceeds, until by the time the critical period* is approaching they are all gone. These plates stain a jet-black with iron hæmatoxylin, and this betrays a germ-cell at once wherever it may be. But of course, in identifying such a cell as germinal, one must take other characters into account. So long as the germ-cells of any embryo possess yolk plates, they remain in a state of rest and undergo no increase in number. In Scyllium this lasts until the embryo is 25-26 mm. in length, the critical period being here reached with 32-33 mm., in Raja until upwards of 50 mm., the critical period being attained at 65-66 mm. The result is that the original germ-cells, termed by me the primary germ-cells, excepting any which may degenerate, remain constant in number* for a very long period of the development. Their products, when they do divide, are termed secondary germ-cells. With the first formation of these in the meantime my researches close, but the subsequent history up to the ripening of the sexual products has been followed out very fully by Balfour and Semper, while we owe further details as to oogenesis and spermatogenesis in Elasmobranchs to the work of Rueckert and Moore.

The observations originally began with the tedious but instructive counting and tabulation of the primary germ-cells of skate embryos of about 30 mm. This work is anything but pleasant, albeit it has occupied much time during recent years, and the writer can perhaps flatter himself that he has now counted and tabulated the germ-cells of more embryos of various species than any other investigator is likely to do for some time to come. From the counting and tabulation, two results among others stand out prominently. These are, that the number of primary germ-cells is a constant quantity for the species, and that during long periods of the development, in Pristiurus in embryos from 4 mm. to 20 mm., in Raja from 6 mm. to 42 mm., no single embryo ever has all its germ-cells in the normal position. (Fig. 3).

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* In two memoirs, "Certain Problems of Vertebrate Embryology" and "The Span of Gestation," the nature and peculiarities of the critical period have been dealt with in full. This period is that at which "the embryo" is first present in all its parts, and when it is first beginning to resemble the form whose offspring it is. It is at this epoch that the sex is first announced, that the embryo first begins to nourish itself (by digesting yolk or by forming an allantoic placenta, etc.), and that larval structures begin to degenerate. Though even now the existence of this epoch is still ignored by embryologists in general, this circumstance in no way lessens its importance. It is only in embryological test-books and in the researches of upholders of epigenesis and direct development that the peculiarities of the critical period meet with no appreciation. But Nature herself is unable to accomplish that which embryologists find so easy, the abolition of the critical period! The critical period and its phenomena andpeculiarities have far reaching bearings upon the problem and cure of cancer. (See "The Lancet," Feb. 4th, 1905.)

* In a recent work upon "Practical Embryology," Minot characteristically states that only the germ-cells of Acanthias have as yet been investigated! Like nearly every fact concerning the germ-cells of Elasmobranchs described in the present writing, the constancy in number escaped the notice of Woods, the pupil to whose work Minot refers. Indeed, beyond the demonstration of the glaring inaccuracy of Minot's dogmatic assertions concerning the germ-cells, which were never based in observation, it is hard to say what Woods' work really proves. Woods' paper appeared on May 26th, 1902, while the writer's first account of the germ-cells of Raja was published at the close of 1900.

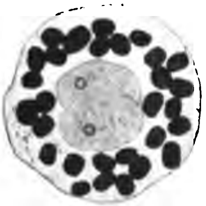

FIG. 1.

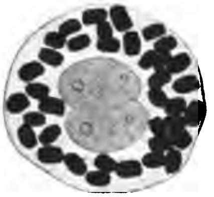

FIG. 2.

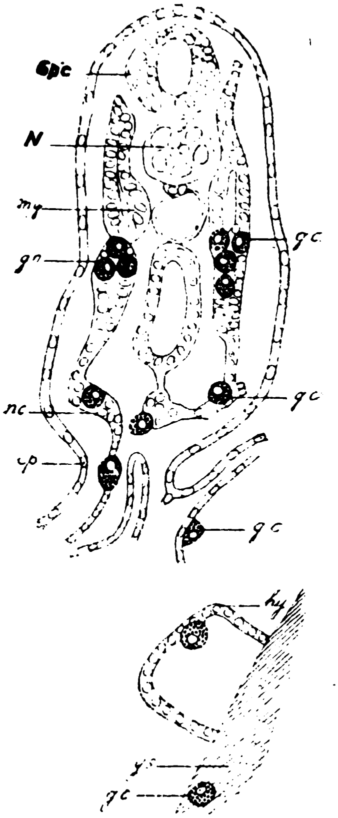

FIG. 3.

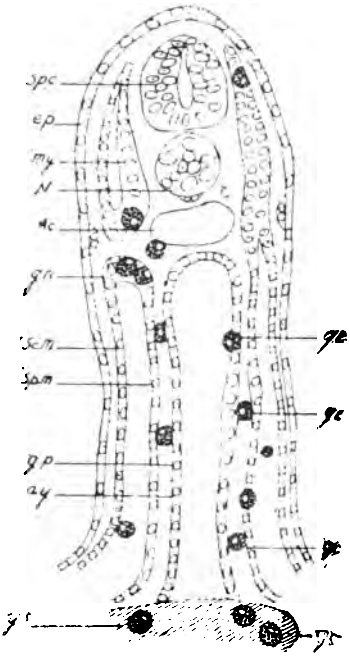

FIG. 4.

Fig. 1.—Primary germ-cell of *Pristiurus melanostomus*. The cytoplasm is glassy in character and contains a large number of (blackened) yolk-plates. The nucleus exhibits duplication, *i.e.* autonomy of paternal and maternal portions.

Fig. 2.—Primary germ-cell of the skate, *Raja batis.*

Fig. 3.—The conditions seen in two transverse sections (the 39th and 41st sections of a row) of a 4½ mm. embryo of *Pristiurus.* The lettering is as follows: sp. c. = spinal cord, n. = notochord, my. = myotome, g. n. = germinal nidus, me. = mesoblast, ep. = epiblast, hy. = hypoblast, y. s. = yolk-sac, g. c. = germ-cell.

Fig. 4.—A *diagrammatic* section of an early skate-embryo. To illustrate the migrations of the germ-cells along the germinal path, g. p., and showing germ-cells in various abnormal situations. The lettering is as in Fig. 3, excepting so. m. = somatic mesoblast, sp. m. = splanchnic mesoblast, ao. = aorta.

As to the bearings of these results, the first is undoubtedly extremely important in aiding in the conception of a morphological continuity, while the second, though it has no direct bearings upon this question, helps to undermine and destroy the view of a somatic origin of germ-cells. If there be a somatic origin of germ-cells it must be possible for them to arise anywhere and everywhere in the body, for there is hardly a single organ in the whole body free from the risk of possible "infection" by such aberrant or vagrant germ-cells.

The counting of the germ-cells can only be carried out with any degree of accuracy in what, under modern microscopial methods of research, are fairly thick transverse sections. I incline to think that the resulting total is always, or nearly always, somewhat too high. It is rarely, if ever, too low; for it is far easier to make the mistake of counting a germ-cell twice, than it is to overlook one. At the best, even when one has obtained a theoretical number, there may have been one or two more, which have degenerated, or failed to enter the embryo, or these may still be in the yolk-stalk or yolk. In many instances, especially in Pristiurus embryos, from two to eight germ-cells have been encountered in the yolk-stalk, and in very early embryos some of them may lie either in the upper part of the yolk, or anywhere upwards from it to the level of the germinal nidus and higher. In text-figure 3 the appearances seen in two neighbouring sections of an embryo of Pristiurus (No. 47=4½ mm.) are depicted, and in it is shown vividly the "line of march" of the germ-cells from the yolk-sac, y.s., to the germinal nidus, g.n.

For questions relating to the enumeration, therefore, it is necessary to deal only with embryos in which the migrations of the germ-cells are finished. In the skate such embryos are those from 16 to 42 mm., in Pristiurus those from 5 mm. to 20 mm. or so. The very first embryo in which the germ-cells were closely studied, R. batis, No. 454, showed them so brilliantly marked off, like black beads of large size, from all the other cells, that the idea suggested itself of attempting to count them. The total came to 512. I now know that this number cannot have been absolutely correct; but, as in other and later cases, the "error of observation" is probably not usually greater than about equal to the number of germ-cells not really in the embryo but in the yolk or in degeneration. Some other instances also gave approximations to 512, while still others yielded a different total, about 256. As big eggs and little eggs, respectively female and male in destination, were already known in Hydatina senta, Dinophilus gyrociliatus, and Phylloxera coccinia, a natural suspicion arose that something of the same sort was at the bottom of the two numbers, and this was confirmed by the circumstance that every case taken seemed to approximate to 256 or 512. How much labour the solution of a trifling problem of embryological research may entail, may be gathered from the statement that it took three months of hard work to establish beyond question the fact, that potential male embryos of R. batis possess a number of germ-cells approximating to 256, potential females to 512. Without at this juncture entering further into the matter, it may be added, that this find was the starting-point of a further invesigation into the determination of sex.

It was then found that in Scyllium and Pristiurus the number of primary germ-cells approximated to 128. Thus, for 30 embryos of the latter the average total of 126.73 was obtained. As the theoretical original number was 128, and as one of these had gone to the unfolding of an embryo (to contain the rest), the actual find here is practically identical with the theoretical number. From these and other cases it was concluded that the number of the primary germ-cells was always one of the series, 2, 4, 8, 16, 32, 64, 128, 256, 512, etc. minus 1, or 2n—1. In passing, it may be added that in certain abnormal embryos either very few or practically no normally-placed germ-cells were found either upon one or upon both sides of the body, and once more this points to their origin outside the embryonic body. This is certain; that is to say, it can be established, that the germ-cells arise before there is any embryo, and that on its formation they migrate into it along the connection between embryo and yolk-sac, the yolk-stalk. These migrations begin very early, even before the closure of the meduallary plate, and they do not go on for any great length of time. In Pristiurus the germ-cells are most easily found in migration in embryonic foundations of 2—4.5 mm., in Raja batis in such of 4—8 mm. (Figure 4.)

Owing to these migrations from the yolk-sac and blastoderm, it never happens that all the germ-cells find their way into the normal position, the germinal nidus or its future site, but a percentage of them (25-30% in the skate, 10-12 per cent. in Pristiurus) comes to lie in one or other of a great number of places really foreign to them. Thus, sometimes they may be found in the head, head-somites, brain, the gill-region, the skin of the trunk or head, the pericardium, the liver, even occasionally in the blood, the kidney-tubules, the body-cavity, myotomes, spinal cord, gut-epithelium, especially of the yolk-stalk and of the rectum, etc., etc.—in fine, there is hardly a place in the whole trunk or head in which such aberrant germ-cells have not been observed. (Compare the diagrammatic figure, Fig. 4.) For a long time the notochord was one such exception, but finally one of my pupils found a germ-cell even there. At the moment of writing the thymus and thyroid are about the only places in which vagrant germ-cells have not been encountered. Usually they remain in such places, often becoming encapsulated; at all events these things are true of those in the older embryos, and many of them, whether or not the majority cannot be stated, degenerate there. The phenomena of their degeneration by simple atrophy have been described elsewhere. Regarded in the light of other results upon the life-cycle and upon the mode of development of "the embryo" from one such primary germ-cell, there is a strong temptation, which the writer has not resisted, to bring certain of such aberrant germ-cells into genetic relationships with the tumours and carcinoma. (Compare the list of literature.)

But the primary germ-cells can be carried back to still earlier periods of the development. In the later phases of the cleavage their identification is not a matter of great difficulty; and from the study of the cleavage, the size and constitution of the blastoderm at fertilisation, and from the sizes of the primary germ-cells themselves, it can be shown that the primary germ-cells date back to a cell of about the tenth cleavage phase as the primitive germ-cell (U.K.Z. of the diagram). In the skate, Scyllium and Pristiurus, there are about ten divisions of the egg before the appearance of U.K.Z., the primitive germ-cell, and of this latter there are seven further mitoses in Scyllium and Pristiurus, eight in potentially male skate, and nine in potential females.

These data are so important that it may be of interest to give some details respecting them. We have already seen that the primary germ-cells have an average diameter of 0.02 mm., and that their number is a constant one. Assuming them to have arisen in the course of the cleavage, it may be asked, "from a cell of what size can they have taken their birth?" The microscopical sections of germ-cells are, of course, segments of spheres of a radius of 0.01 mm. From these data it is not difficult to calculate out the size of a sphere which by regular equal divisions would ultimately give as its products, for instance, 128 spheres of 0.01 mm. radius. Moreover, the germinal disc of an Elasmo-branch egg, and this is the real functional egg which alone undergoes cleavage, is practically a hemisphere of a certain radius. If, starting again from the size of the primitive germ-cell, further calculations be made, we soon reach the size of hemisphere corresponding to the original germinal disc, whose size we know. In this way tables of the following kind are obtained:—

Ascending series of spheres of double volumne, calculated from the starting-point of 0.01 mm. radius by Dr. J. H. Ashworth. This table is given as a preliminary result. Dr. Ashworth and the writer intend to make a further examination and control of the figures and measurements.

	Radius mm.	Diameter mm.	Skate.	Germ-cells. Skate.	Scyllium.
1.	0.01	0.02	512	256	128
2.	0.0125	0.025	256	128	64
3.	0.0159	0.031	128	64	32
4.	0.020165	0.04	64	32	16
5.	0.0252	0.05	32	16	8
6.	0.0314	0.062	16	8	4
7.	0.039	0.078	8	4	2
8.	0.049	0.098	4	2	1 =U.K.Z.
9.	0.058	0.116	2	1 =U.K.Z.	(1)

10.	0.061	0.1234	1=U.K.Z.	(1)	(2)
11.	0.076	0.1536	(1)	(2)	(3)
12.	0.096	0.1934	(2)	(3)	(4)
13.	0.12058	0.24	(3)	(4)	(5)
14.	0.1512	0.30	(4)	(5)	(6)
15.	0.189	0.378	(5)	(6)	(7)
16.	0.2394	0.478	(6)	(7)	(8)
17.	0.302	0.6	(7)	(8)	(9)
18.	0.378	0.75	(8)	(9)	(10)
19.	0.478	0.95	(9)	(10)	
20.	0.6	1.2	(10)		
21.	0.75	1.5			

The interval between each line in the table represents a mitosis. The first column gives the key to the number of mitoses in any form. The second and third columns show the sizes of the radii and diameters respectively of the cleavage segments (spheres) formed. The remaining three columns give the cleavage in the female skate, the male skate, and in Scyllium. Thus, in the female skate there are 512 primary germ-cells, and these are seen to go back to a cell of 0.1234 mm. diameter as the primitive germ-cell. The blastoderm has a diameter of 1.5 mm., but this is a hemisphere, and, therefore, in the table the cleavage of the female skate seems to start at line 20 with a sphere of 1.2 mm. From U.K.Z. to this point there are 10 divisions, and, therefore, in the development of the female skate there are to the formation of the primary germ-cells from the commencement of the cleavage in all 19 mitoses. In the development of the male skate there are only 256 primary germ-cells of 0.02 mm., and therefore one cleavage less; but here the disc at the beginning of cleavage is less than in the female skate, having in fact a diameter of 1.2 mm. (hemisphere). On the other hand, in Scyllium there are 128 germ-cells; these start from a primitive germ-cell of 0.098 mm. diameter, and the original blastoderm has a diameter of 0.95 mm. (hemisphere). In Torpedo ocellata, the germ-cells are smaller than in Raja and Pristiurus, and they are comparable in size to the products of the first division of the germ-cells of the latter. Apparently they have gone through an additional division, but, although their number is not yet known, from their sizes and from that of the blastoderm, which is smaller than that of Pristiurus, it is not difficult to unravel the facts. The blastoderm of Torpedo has a diameter of 0.75 mm., the primitive germ cell probably has a diamater of 0.078 mm., and, as likely, there are 128 primary germ-cells. In this form the germ-cells have not yet been counted; because, although they possess yolk while outside the embryonic body, they would seem to lose this as soon as they enter the embryo. In this way they become lost to sight.

The facts just described tempt one to make a slight digression. The number of cell-divisions, from any given point in the life-cycle to any other given point, in all probability is for any given species a constant quantity. This is a matter of some importance, as will ap-

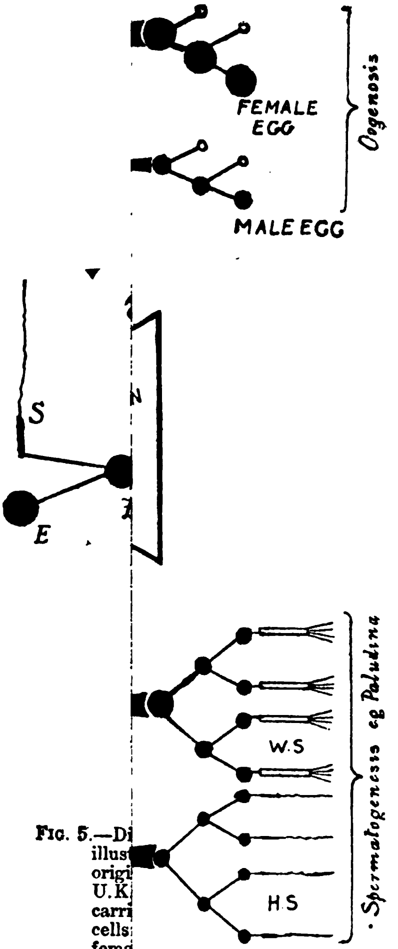

Fig. 5.—Di
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pear later. In man it is not known, nor soon likely to be, how many divisions of the egg (zygote) take place before the appearance of U.K.Z., the primitive germ cell. Allan Thomson calculated that in one ovary of a new-born infant there were about 70,000 eggs (oocytes).* As one might expect, this number is somewhat too high, the real maximum being about 65,000 at most. There are here, therefore, not more than 16 divisions from the primitive germ-cell to the formation of the oocytes, and it is, perhaps, not a matter of very great import at the moment, in which of these the primary germ-cells appear. As to the primitive germ-cell here, I incline to the belief that it is formed not sooner than the third or fourth cleavage and not later than the tenth.

III. THE METAZOAN LIFE-CYCLE.

The things briefly described in the preceding chapter furnish the key to the problem of the Metazoan life-cycle and mode of development. For facts such as these the writer had, without having any idea of their real nature, searched for years again and again, but in vain. As long as it was possible to maintain the doctrine of a somatic origin of germ-cells, there appeared some reason for regarding the mode of the development as direct; and, though certain phenomena pointed significantly enough to an antithetic alternation of generations, under the view of a somatic origin of germ-cells it could not be demonstrated that an antithetic alternation must of necessity underlie the facts.

With the finds relating to the primary germ cells it at length became possible to fill in a portion of the diagram (text figure 5), which in former years had been a complete enigma. It was long clear that "the embryo" at a certain epoch, the critical period, began to suppress the asexual foundation, the phorozoon, upon which it had arisen. But how, and out of what, an embryo had been evolved, was the greatest puzzle which in embryological research I have ever encountered. It had, indeed, long been foreseen that something resembling the formation of spore-mother-cells in the Metaphytah was demanded, if a cycle comparable in any way to that obtaining in the vegetable kingdom underlay the development. As already stated, this was on investigation missing, because it was not searched for in the right place. (Fig. 5).

But now it is at length quite clear that the formation of the primary germ-cells (text figure 5) in the skate—and in all probability in every other Metazoon, for it is not possible that two fundamentally different modes of Metazoan development should exist—corresponds broadly to the genesis of spore-mother-cells on the asexual generation of a plant, the sporophyte. With this recognition the basis of a comparison between the phenomena of the life-cycles of the Metazoa and the Metaphyta, so as to show their essential similarity, is afforded. In the same way, the discovery of the formation of the primary germ-cells, and of the epoch of their coming into being, throw new and unexpected light on the course and nature of heredity, as well as upon variation.

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* In this the "granulosa" cells, which are degraded germ cells, are not taken into account.

These are the chief results of my work on the germ-cells; and, though other and doubtless important finds have been made, the latter sink into insignificance when placed beside the former.

Certain parts of the diagrammatic figure (Fig. 5) have been adopted, as already stated, from the writings of other embryologists. This, however, has not been done without important modifications, for which the writer is alone responsible. Originally, towards the close of 1900, Boveri's diagrams of oogenesis and spermatogenesis formed and filled in portions of the life-cycle. Doubts arose as to their completeness, in view of the existence of two sorts of eggs and two kinds of sperms in certain cases, and the working-out of the probable course of oogenesis in the skate finally resulted in the modifications here depicted. The first part of the figure, from the zygote, Z., formed by the union of egg and sperm, to the primitive germ-cell U.K.Z. (the "Ur-Keimzelle" of German authors), is from Boveri's and Weismann's figures. Their diagrams and conclusions, however, go no further than U.K.Z., and in their figures the line from Z. to U.K.Z. marks what Weismann terms "the germinal track" (Keimbahn), and the products to the left of it are assumed to be cells of the embryo! As in the skate or other Elasmobranch there is no possibility of the existence of any part of an embryo prior to the formation of U.K.Z. it is out of question that the said cells can be part of this. It is a pure assumption that they are parts of an embryo; and in Ascaris megalocephala, for instance, to which Boveri's identical diagram refers, it has never been established—and be it added, it never will be determined—that directly from the cleavage of the fertilised egg the sexual generation or embryo, as it occurs in the horse, takes its origin. The later history is here unknown. If it be imagined possible that here, by direct development, the sexual form of Ascaris, as it is found in the horse, can arise, a reference to the account of Maupas, results (6) of investigations into the life-histories of a number of Nematoda will dissolve the illusion. Indeed, it may safely be predicted that, when the facts become known, of the two primary germ-cells of Ascaris, formed by division of the cell U.K.Z., the one will be seen to form an embryo or sexual generation, while the other will furnish its sexual products. It will, doubtless, be urged that on my part also it is an assumption that the cells to the left of the line Z. to U.K.Z. give origin to the larva or phorozoon. In a sense this is true; but the one supposition is prima facie as good as the other, and on the further evidences to be added it is a good deal better. Moreover, it has never yet been demonstrated for any animal whatever that the first cleavage products go towards the formation of an embryo, whilst it has often enough been proved up to the hilt that in many instances in

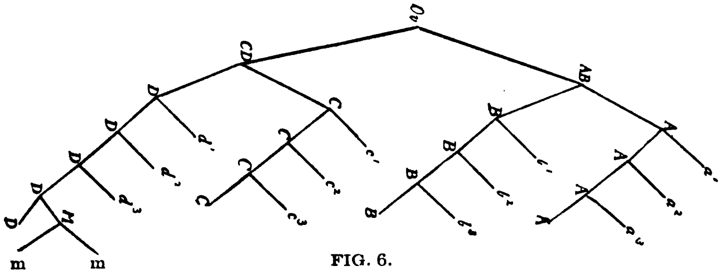

FIG. 6.

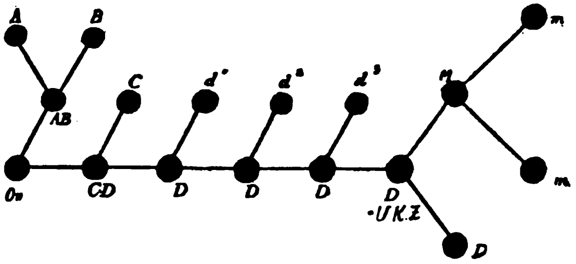

FIG. 7. Egg Cleavage of Neresis.

various divisions of the animal kingdom they are concerned in forming parts of a series of temporary and transient organs, making up the larva, not in the least identical with or comparable to an embryo*

From the existence of a transient nervous apparatus, a blastoderm, and other evanescent structures, the conclusion was long ago arrived at that there was a phorozoon or asexual generation in the life-cycle of the skate, etc. From all the known facts of embryology such a phorozoon cannot arise out of an embryo; it must precede an embryo. There is no embryo by the time the period P.G.C. of the figure is reached, the formation of such commencing here. Therefore, the first products of the cleavage—up to the tenth division—apart from the line leading to U.K.Z. must be the phorozoon, or asexual generation. There is abundant testimony of the truth of this conclusion in the literature of embryology, but evidence from another side will be found in, for instance, E. B. Wilson's published researches upon the cell-lineage and development of Nereis.

There was at first some hesitation in the writer's mind as to the possibility of using Wilson's results (7) in support of the view here presented of the nature and destiny of the first cleavage products. A perusal of the lecture cited below served to remove this. His work of 1892—and his more recent results—must be taken together, for Wilson himself has seen reason to alter his earlier interpretation in some light but important respects. These amendments are exactly of the kind required for my reading of his table of the cell-lineage. In text-figure 6, Wilson's table, so far as it concerns us, is reproduced, and in Fig. 7 the like results are exhibited after the manner of Boveri's figures, or the part of my diagram from Z. to U.K.Z. in Fig. 5. The writer's main difficulty is his reading of Wilson's diagram was the supposed destiny of the cell d2=x. From page 30 of his recent lecture it may be gathered that the author, following the finds of Lillie in Unio, now looks upon this cell x as representing a "larval" mesoderm cell. This is exactly the fate it ought to have; for, as we have seen, everything to the left of the line Z. to U.K.Z., must belong to the phorozoon or larva.

The primitive germ-cell has not yet been identified in Annelida. The facts look as though it arose in Nereis at the fifth cleavage as the cell in text-figure 7 labelled D.=U.K.Z. This then divides into (two primary germ-cells) D and M. "M." is the primary mesoderm-cell or somatoblast of various authors. Its division initiates the period of bilateral cleavage, and its products form the two "mesoderm-bands," i.e. the foundations of the worm. In contra-distinction to other authors, the writer must maintain the opinion that M. is a primary germ-cell, and that it gives rise to the whole of the sexual generation, in this case the worm. In this connection it may be of interest to recall the circumstance that long ago Hatschek expressed the view that the two products of M., the well-known "pole-cells" of Hatschek, were originally eggs. This suggestion has been criticised by Kleinenberg. If the pole-mesoderm-cells be not "eggs"—and most certainly they are not—they at least arise by the division of the next thing to an egg, a primary germ-cell. Wilson, on the other hand, approves of E. Meyer's amendment of Hatschek's view into a correspondence of the mesodermal bands with—paired gonads! This is multiplication of causes with a vengeance! In the restricted sense indicated above there is something to be said in favour of Hatschek's interpretation: the other idea is wildly impossible.

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* In the best investigated cases, that is to say, in all the instances which have been closely studied, it is established that the products to the left of the line are all larval or asexual in destination, and that they do not go to form parts of the embryo. Moreover, until the publication (Jan. 1902) of my figure, nothing whatever was known of the subsequent history after U.K.Z. down to the formation of the primary germ-cells. That is to say, Boveri's and Weismann's figures, if taken as showing either the course of the life-cycle or the track of heredity, would be like the play of "Hamlet" with the chief character omitted!

In Nereis the further destination of the remaining primary germ-cell D is unknown, beyond that it comes to form part of (i. e. to lie in) the hypoblast. There is no difficulty about this. Even in the skate many of the primary germ-cells may for a time lie in the hypoblast, but thew do not give rise to hypoblastic cells. As Dr. Wilson remarks, "the untimate court of appeal . . . lies in the fate of the cells" (loc. cit., ii. p. 41).

Another apparent difficulty, more especially to the view of the complete similarity and equivalence of the primary germ-cells, would be that possibly sometimes the embryonic cell, the somatoblast, may exceed the primary germ-cells in size. But this very difference in size—assuming it exist—may serve to explain why some particular primary germ-cell is chosen to unfold as an embryo instead of some other. Position alone cannot always be at the bottom of this. In the skate, for example, the embryo does not invariably begin to arise at one certain spot upon the blastoderm. It may be that the stimulus afforded by an extra amount of food-yolk may have much to do with the initiation of development.

Very suggestive and significant, in the light of my researches upon the germ-cells, are the following passages from E. B. Wilson's Nereis memoir. Statements equally pregnant with meaning will be found in Eisig's work on the development of Capitella (8). On p. 393 Wilson writes: "Transition to the Bilateral Period—As far as the development of the permanent organs is concerned, the transition form the spiral to the bilateral type of development is remarkably abrupt.". It may be mentioned that at the close of the spiral period there are, according to Wilson, 38 blastomeres present. That is to say, the majority of them are products of the fifth cleavage.

On p. 444 he asks: "What is the significance of the spiral and bilateral forms of cleavage, and where lie the causes that determine the transformation of the one into the other?" Further on he writes: "The most striking feature in the cleavage and the one on which the entire discussion may be made to turn, is the sudden appearance of bilateral symmetry in the cleavage. The meaning of the bilateral cleavages in themselves is perfectly obvious. They are the forerunners of the bilateral arrangement of parts in the adult, and, as such, these explanations belong to the general problem of bilateral symmetry, which need not be considered here. The all-important point is that the bilaterality does not appear at the beginning of development. It appears only at a comparatively late stage, and by a change so abrupt and striking as to possess an absolutely dramatic interest." And so on. I refrain from further quotation because Wilson's work contains no real solution of the problem. To my mind the solution was lacking because, on the one hand, it was not recognized that the mode of development was by means of an alternation of generations; and, on the other, the history of the primary germ-cells of Nereis was, and still is, unknown.

If the reader will compare Wilson's statements with the course of development depicted in my diagram—not forgetting, I trust, that the latter is a diagram and nothing more—the meaning of the spiral cleavage and of the sudden and abrupt change, of which Wilson writes, may become apparent. The apical mode of growth, so characteristic of the early formation of the asexual generation in both plants and animals, and which is retained for the whole life-span of the sporophyte of plants, might also be described as spiral. Indeed, it is so regarded and described by botanists. With the cutting-off of the connection between the primitive germ-cell and the asexual generation or phorozoon, we witness the practical end* of the spiral mode of cleavage and the commencement of the bilateral period. With this the formation of the primary germ-cells is connected; and, following the genesis of these, a start is made in the unfolding of an embryo. In this way my diagram gives a general interpretation of Wilson's finds, not to mention those of other observers. And thus the phenomena, observed in the development of Nereis, are seen to be due to an antithetic alternation of generations, where the asexual generation arises in a spiral or apical manner, where the sexual generation is characterised by a bilateral mode of formation, and, lastly, where the formation of a primitive germ-cell, and of "x" primary germ-cells from this, may be predicted between the two generations; that is to say, prior to the development of the sexual generation. It is perhaps possible that in some animals, e.g. Annelida, the conditions at p. g.c. in Fig. 5 would be more accurately represented by a rotation of the line of p. g.c. through a right-angle.

In the course of all the years spent in the attempt to unravel the mode of Metazoan development, at various times many things have seemed inexplicable; but, wherever their history has been discovered—and with patience and pertinancity this has usually happnned—they have been found to fit into an anithetic alternation of generations, and into nothing else. If Wilson's find be not based in such an alternation, but be in connection with a "direct" mode of development, they would seem to include facts which will never be explicable, for logically such a roundabout kind of development cannot be termed "direct." Or, shall we explain and describe them as the development of the Scyphozoa or higher Medasae is recited in almost all the current text-books, by the omission of any reference to the main portion of the asexual generation, the creeping stolon, discovered by Sars (9)? Such a course may simplify matters, but it hardly makes for the discovery of the facts of nature!

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* The practical end, but not the actual termination; for, as Wilson points out, "it is only in the peculiar changes involved in the formation of a larval organ, the prototroch, that the spiral form of division overlaps the bilateral period" (op. cit., p. 393). The "prototroch" is a circlet of cells from which the praeoral ciliated band arises.

Reverting to the diagram of the life-cycle of the skate, at present it is possible only by comparison and induction to show the fate of the cells to the left of the "germinal track" as far as U.K.Z., the primitive germ-cell. The comparison with other cases only goes to prove its correctness, and, I am convinced, the number of such will increase in the proportion as the study of cell-lineage, so ably established by Whitman, Mark, and E. B. Wilson, replaces the bootless pursuit of the three sacred layers of embryologists.

Up to the point U.K.Z. of the diagram the germinal track in Weismann's sense lies apparently in the larva. It may be objected that in making this substitution in favour of the phorozoon, the embryo has been displaced, and that the germinal track is here somatic. The reply is that the cell U.K.Z. and its immediate ancestors never form part of the larva, and the period from Z. to U.K.Z.—no matter how long it be, whether four cell-generations as in many Invertebrata, or ten as in the skate, etc., or four thousand—is marked by a mode of growth and cell-division conspicuous by absence in other parts of the diagram.*

This statement requires both elucidation and emphasis. The mode of growth of the sporophyte in plants is essentially apical; that is to say, wherever there is an apex there are always one or more apical-cells, which by their division give off products towards the centre. In the sexual generation of a Metazoon the mode of growth differs in toto from this; for here all the products ultimately undergo differentiation, and embryonic or germ-material, corresponding to apical cells, has no existence. The older embryologists of the first half of the nineteenth century thought differently, and some pathologists still cling to their views, but these have no shadow of foundation in fact.

The initial mode of growth and formation of the asexual generation or phorozoon in animals—an organism never of a very high degree of organisation—is entirely comparable to that of a sporophyte. As in simple cases of the latter, there is here one "apical cell," which never itself forms part of the phorozoon, but instead thereof gives off into the latter a greater or less number of products, while retaining its own unicellular or Protozoan character. Nor would the conditions be altered, were there several growing points, as generally met with among the Hydrozoa.†

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* Spemann has already compared the mode of origin of the first cleavage products in Nematodes, more especially in Strongylus, to the apical mode of growth in the sporophyte of a plant. He notes that the cell along the line Z.-U.K.Z. in my diagram acts as though it were an apical cell of a sporophyte ("Die Entwicklung von Strongylus paradoxus," in Zool. Jahrb. Morph. Abteil., vol. viii., p. 304, 1894-95). This author, one of the ablest of younger embryologists, almost, indeed, anticipated the discovery of a morphological continuity—to a much greater degree than Boveri and Weismann, to whom Waldeyer gives the credit.

Sooner or later upon the phorozoon the primitive germ-cell enters into activity. It may divide before the phorozoon is properly differentiated, as nowadays is certainly the case in many instances, or, theoretically, its divisions may happen at a later period. These divisions, however, must, of necessity, precede the formation of an embryo or sexual generation. In the skate and Pristiurus, etc., the divisions of the primitive germ-cell which give birth to the primary germ-cells, take place before the phorozoon is fully differentiated, and, of course, before there is any trace of an embryo. In all these Elasmobranch fishes yet studied by me, the commencement of the divisions of the primitive germ-cell would appear to date from about the tenth cleavage phase, and in the skate there are either eight (male) or nine (female) divisions.

In the portion of the diagram showing the origin of the primary germ-cells, these have only been drawn to seven divisions, giving one hundred and twenty-eight. To exactly embrace the full significance of the discovery, the drawing ought to include two further divisions, yielding five hundred and twelve germ-cells at P.G.C. That is to say, to represent accurately the conditions in Raja batis, No. 454, for example, the diagram ought to be at P.G.C. four times as wide at it is at present* Its width is about 16½ centimeters; it ought to be about 66.

The division of the primitive germ-cell into primary germ-cells is a well-marked epoch in the life-cycle, and one of the greatest possible moment. Hitherto its import has been overlooked by every embryologist, and its record was made for the first time as one of the results of the Raja-researches. From every point of view it is as important as the phenomena to which embryologists attach the term "maturation," and probably its essential necessity in development will not need to wait long for ample recognition in Embryology.

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† It should be mentioned that de Vries and Weismann have already noted the resemblance in mode of growth between the sporophyte and the colonial Hydrozoa. Many of the latter also possess the indefinite unrestricted power of growth, so characteristic of the sporophyte of the higher plants. As a rule the asexual generations of the higher Metazoa do not exhibit this faculty. They rarely obtain a chance of showing it, for it is their usual fate to undergo early suppression by the sexual generation. When, as happens sometimes in the human subject, either no embryo is formed, or it degenerates or aborts prior to or at the critical period—a common epoch of abortions—the asexual generation, the trophoblast or chorion, may go on growing indefinitely, if left in the uterus (hyotid mole, choriepithelioma).

* This fact must be borne in mind, in order to appreciate fully the true bearings of the finds upon problems of heredity and variation. At the time a female skate embryo, for example, commences to develop, there are about 500 understudies of it in existence.

The number of the products of the primitive germ-cell is very large in the skate—as many as 512. But it must be pointed out, that this number furnishes no criterion for other animals. There may be cases in which it is larger, though, I imagine, the occurrence of many such is unlikely. Undoubtedly there are instances in which it is much smaller; and probably these are well represented among the Invertebrata. In short, it may be as low as two; but as the sexual generation or embryo must arise from one product, and as this must contain some sexual elements, it can never be lower than two. In other words, the primitive germ-cell must divide at least once, yielding two primary germ-cells, of which one will give rise to an embryo, and the other will supply the "sexual products." Apparently, it divides once in Cyclops and Ascaris megalocephala, twice in Cecidomyia, and thrice in Chironomus.

As to the rest of the diagram, this relates to the divisions of the primary germ-cells into secondary germ-cells within the embryo, the determination of sex, and the final phases of oogenesis and spermatogenesis. As already stated, the primary germ-cells remain quiescent during the unfolding of the parts of the embryo, and just prior to the critical period they commence to divide and form secondary germ-cells. Of the number of these divisions in any form, nothing is known, but it is certainly always a definite one, though not necessarily the like one in both sexes. Indeed, it is almost certain, that a germ-cell, whose ultimate products will become male eggs, divides at least once oftener than one whose destiny it is to furnish female eggs. It is also of importance to note that the divisions of the primary germ-cells precede the revelation of the sex of the embryo, and in some way or other are connected with it. The final products of the secondary germ-cells are termed oogonia and spermatogonia respectively. In the final division of these into oocytes and spermatocytes as described in a later chapter, the important phenomenon of the reduction of chromosomes takes place. As will be seen in other chapters, this phenomenon underlies the determination of sex, and all the phenomena of heredity, etc.

With the exception of the portions of the diagram relating to the determination of sex, the data concerning oogenesis, etc., are taken, as will be recognized, from Boveri's well-known figures. Of course, the embryo is not supposed to be hermaphrodite; both sexes being included in one diagram merely for purposes of convenience. In the upper part of the diagram, attached to the ninety-sixth primary germ-cell, the course of oogenesis in the skate is shown. With the final division of the oogonium into two oocytes, o.c., the determination of sex is depicted as happening in the formation of male oocytes and female ones. These enter the period of growth, and then pass on to ripen.

Lower down, for comparison, the spermatogenesis of Paludina, a fresh water dioecious snail, with its two kinds of spermatozoa, is represented after the statements of Meves. The portions of the diagram appended to the ninety-sixth and thirty-second primary germ-cells, can naturally be applied to any of the remaining primary germ-cells, other than that which goes to form the embryo.

In the foregoing, what Weismann has termed the germinal track, nowhere touches the cells of the embryo. Neither as we have seen, does it really lie within the asexual generation or phorozoon. It is along a line of unicellular organisms, which pass a portion of their life-cycle between one conjugation and the succeeding one within a sterilised individual, formed by the self-sacrifice of one for the good of the rest.

As revealed by the diagram, throughout this line of unicellular organisms, which are ever such,. until one or other of them gets into the cul-de-sac of embryo-formation, there is a direct morphological continuity of germ-cells. This is all Nature demands: and this she accomplishes by the aid of unicellular organisms. All the observed phenomena of development, all those of heredity, are possible in this way. Notwithstanding apparent complexity, the process is simplicity itself, the simplest kind of continuity conceivable. On the circle of life revolves the epicycle of the germ-cells. The circumference of the former is filled in by an uninterrupted succession of such epicycles. The constant sequence of these is the rhythm of reproduction, the gamut of life.

1. Weismann, A. "Vortraege ueber Descendenztheorie," vol. i. p. 449, 1902.

2. Weismann, A. Op. cit., vol. i. p. 449.

3. Weismann, A. "Die Continuitaet des Keimplasmas," Jena, 1885, p. 44.

4. Noll, F., in Strassburger's "Lehrbuch der Botanik," 2te. Aufl., 1895, pp. 208-209.

5. Eckermann, "Gespraeche mit Goethe," p. 117, Dec. 9, 1824.

6. Maupas, E. "Modes et formes de reproduction des Nematodes," in Arch. Zool. exper., vol. viii. pp. 463-624 11 pl., 1900.

7. Wilson, E. B. "The Cell-Lineage of Nereis," in Journ. Morph., vol. vi. pp. 361-480, 1892. "Cell-Lineage and Ancestral Reminiscence," in Wood's Holl Biol. Lectures, 1898, pp. 21-42 (published in 1899).

8. Mitt. Zool, Stat. Neapel, vol. xiii. pp. 1-292, 1898.

9. Sars, M. "Ueber die Entwicklung der Medusa aurita und Cyanea capillata," in Arch. Naturgesch, vol. vii., 1841.

Fig. 1.—Primary germ-cell of Pristiurus melanostomus. The cytoplasm is glassy in character and contains a large number of (blackened) yolk-plates. The nucleus exhibits duplication, i.e. autonomy of paternal and material portions.

Fig. 2.—Primary germ-cell of the skate, Raja batis.

Fig. 3.—The conditions seen in two transverse sections (the 39th and 41st sections of a row) of a 4½ mm. embryo of Pristiurus. The lettering is as follows: sp. c.=spinal cord, n.=notochord, my.=myotome, g. n.= germinal nidus, me.=mesoblast, ep.=epiblast, hy.=hypoblast, y. s.=yolk-sac, g. c.=germ-cell.

Fig. 4.—A diagrammatic section of an early skate-embryo. To illustrate the migrations of the germ-cells along the germinal path, g. p., and showing germ-cells in various abnormal situations. The lettering is as in Fig. 3, excepting so. m.=somatic mesoblast, sp. m.=splanchnic mesoblast, ao.=aorta.

Fig. 5.—Diagram of the life-cycle of the skate, Raja batis, or of Scyllium or Pristiurus, illustrating the union of the egg and sperm, E. and S., to form the zygote, Z., the origin of the phorozoon or asexual generation, the germinal track from Z. to U. K. Z., the latter being the primitive germ cell, the divisions of the latter are carried to seven mitoses, as in Scyllium or Pristiurus, giving 128 primary germ-cells at P.G.C., instead of the full number of nine divisions in a potentially female skate, yielding 512 primary germ-cells. Diagrammatically the unfolding of one primary germ-cell, the 66th, is depicted as forming an embryo or gametozoon. To complete the track of heredity from generation to generation through the morphological continuity of the germ-ceslls a diagram of oogenesis has been appended to the 96th germ-cell, one of spermatogenesis to the 32. In the former, the formation of a male-egg and of a female-egg is shown, in the latter the two forms of sperms (in Paludina after the statements of Meves), i.e. the hair-like or functional, and the wormlike or functionless spermatozoa.

Fig. 6.—The egg-cleavage of Nereis (after E. B. Wilson).

Fig. 7.—The egg-cleavage of Nereis.

IV. THE REDUCTION OF CHROMOSOMES.

A cursory survey of the immense literature of oogenesis and spermatogenesis would suffice to demonstrate that the question of the reduction of chromosomes cannot be fully discussed in these pages. It might appear to be foreign to the argument, but it is a phenomenon of universal occurrence in the Metaphytic as well as in the Metezoan life cycle, and its nature is of fundamental import for problems of heredity and variation.

Owing to the duplication in the number of chromosomes which happens at every conjugation of egg and sperm, a reduction to half the number becomes necessary prior to a new conjugation, and hence either conçomitantly with or prior to the formation of new gametes, eggs and sperms. This phenomenon of the reduction of chromosomes occurs, so it is generally admitted, somewhere or other between the formation of oocytes and spermatocytes and the last division of these into cells, which become gametes (Fig. 8 and 9, p.). For a fuller discussion of the matter the reader may consult the memoir upon the "Determination of Sex." Among embryologists there are two views maintained. One of these is (1) that the reduction is effected by the disappearance of half of the chromosomes in the closing phases of the final division of the oogonia into oocytes and of the spermatogonia into spermatocytes, (Boveri and others). The reduced number appears here, but how this disappearance of half the chromosomes is brought to pass, neither Boveri nor any succeeding worker has yet been able to make out. Boveri remarks that the critical point at which observation is brought to a standstill is the nucleus of he oocyte and spermatocyte of the first generation, i. e. at the line o. c. and h. s. p. c. in Figs. 8 and 9. According to him, it is not the reduced number in the actual egg or polar bodies or sperm which requires explanation, but this diminished number in the oocytes and spermatocytes. (2) The second view (Weismann and his pupils and Rueckert) is that the foregoing apparent reduction is not a real one, but that the actual reduction is effected in one or other of the two final divisions of the oocytes and spermatocytes. They maintain that these are preceeded by a conjugation of chromosomes in pairs, and by one longitudinal splitting of each pair. The first division takes place along the line of the split, the second separates the conjugated chromosomes; therefore there would be no loss of chromosomes. On the other hand, Boveri and more recently Boveri and Farmer have changed their views. The "Characters" or Qualities" of germ-cells are not entities and no reason has ever been shown for supposing that the chromosomes represent them. Others hold, and in this they are supported by almost the whole of botanical opinion, that the two final divisions are preceded by two longitudinal splittings of the reduced number of chromosomes. Under this view there is thus an elimination of chromosomes.

This latter point is a very important one, for, if it be true, and to my mind all the evidences seem to speak for it, the products of any oocyte or spermatocyte, usually four in number, will be identical gametes, and not such containing different combinations of characters, as Weismann maintains. Under the simple views adopted in the present writing, the egg or sperm contains within itself one complete set of the characters requisite to form or unfold an individual of the species, like one complete pack of cards of a certain color, red, blue, or green. Moreover, for reasons already entered into elsewhere and repeated in another part of this writing, it is concluded that some important phenomenon takes place in the final division of the oogonia, for example, into oocytes, and that whatever be the causal connection of this (i.e. the reduction) and the determination of sex, the two are linked together and inseparable. If the reduction be the outward and visible manifestation of the the determination of sex, the two are linked together and inseparable. If the reduction be the outward and visible manifestation of the determination of sex, it is easy to understand why it should happen in, for example, the passage from oogonia into oocytes, for undoubtedly the final phenomena of the determination of sex take place here.

If the view advocated by Weismann, Rueckert and others be correct, there can be no connection between the two. This would then be an inexplicable circumstance, and the whole thing with its (under their views) associated phenomena would reveal such remarkable conditions as almost to be beyond comprehension.*

And it appears to be certain that in the mammalia, where only one polar body has been described—in all known cases—there cannot be two divisions of the oocytes. Again, Meves has quite recently published in preliminary form some very interesting observations upon the spermatogenesis of a wasp, Vespa germanica, and the bee, Apis. At the moment the finer details are wanting, but Meves records that in both cases there are the usual two final divisions of the spermatocyte into spermatids. The results of these closely resemble the diagram of oogenesis (Fig. 8). In both cases the first division yields a normal cell and a sort of "polar body" containing no nuclear substance, while the second in Vespa results in two normal spermatids, which become two sperms, and in Apis it furnishes one normal spermatid and a "polar body" containing nuclear substance, but none the less rudimentary in nature. Thus, in these instances, notwithstanding the twofold division of each spermatocyte, in Vespa but two sperms arise, in Apis but one. The work (10) will probably turn out to be of great importance in the light it must throw upon the reduction, and it may quite conceivably finally render the views of Weismann as to the reduction untenable, if they be not so already.

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* The view of the reduction adopted in the present writing is that established by researches of Boveri, Brauer, O. Hertwig, Meves, Strasburger and others, and it was formerly also advocated by Farmer and Moore. In a recent publication (Proc. Roy. Soc., London, vol. lxxii. p. 104-108, 1903) the two latter investigators have arrived at other conclusions, which bear some resemblance to those advanced by Haecker and Rueckert. Boveri's view has the enormous advantage that under it the phenomena of the determination of sex and those of variation, etc., admit of simple and natural explanation. And, moreover, it is supported by the work of some very fine observers.

These latter seem to me to lead into what in research is always carefully to be avoided, a cul-de-sac. There are already more than sufficient cul-de-sacs in embryology—each containing a band of devoted workmen without making new ones or helping to maintain any now existing, and in these pages Boveri's conclusions as to the reduction will be adopted; that is to say, it will be taken as established, that the reduction of chromosomes is effected—not by cell-division—in the closing phases of the final division of, for example, the oogonia into oocytes. Prior to this reduction the nuclei of germ-cells may, and often do, exhibit the duplicated condition and, of course, always the doubled number of chromosomes, and the interpretation to be placed on the matter is that it represents a doubling of all the characters or qualities requisite to form an individual. These, therefore, are twofold, like two packs of cards, red and blue respectively, in the primary germ-cells, and in all the cells, until oocytes and spermatocytes are formed, that is, until the final phenomena of the determination of sex take place. As will be seen presently, this conclusion is of far-reaching import for the problems or heredity and variation.*

V. THE DETERMINATION OF SEX.

Until 1902, all current views as to the determination of sex were based upon the assumption that in the Metazoa there existed but two sorts of gametes, the egg and the sperm. And so sure were embryologists of the truth of this, that they had never attempted to establish it in fact in any one case! As long ago as 1854 Bernard Schultze, from the consideration of the facts relating to double monsters and identical twins, had concluded that two sorts of eggs, male and female respectively in destination, must exist. If this were true, and it certainly is so, underlying the phenomena of sex there must be at least three sorts of gametes, the sperm, the male egg, and the female egg. A fourth kind of spermatozoon, non-functional, had long been nown in Paludina, a fresh water dioecious snail. It was discovered in 1836 by the celebrated zoologist, C. T. von Siebold. Since then second forms of sperms, or the forerunners of such, all non-functional, have been recorded in many animals from various divisions of the animal kingdom, and this number is constantly being added to. So that, indeed, it is known for far more instances, that two forms of sperms or their forerunners occur, than that only one sperm is developed. And of dioecious animals as yet closely studied there are perhaps only two, Ascaris and Salamandra, where a second can with any certainty be said to be absent. In these instances the very numerous degenerate spermatogonia and spermatocytes sufficiently account for its non-occurrence.

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* Many of the advocates of the reducing division speak as though they had OBSERVED it under the microscope! By the results of two recent lines of research, by V. C. de BOINVILLE and by the writer, the existence of a "reducing division" is exploded, for it would appear, that the mode of division, the so-called "heterotype," upon which so much weight has been laid, (and still is), that this kind of division is peculiar to and characteristic of the cell with the reduced number of chromosomes. In certain cases of both male and female germ-cells these divide again and again with the reduced number of chromosomes and always by the "heterotype mitosis!"

The memoir, of which a brief abstract is given in the following, starts by confirming Schultze's conclusion, given above. Soon after it was published, two others appeared, by M. von Lenhossek (11) and Oskar Schultze (12) respectively. These embryologists also confirm the conclusion, that underlying the phenomena there are two kinds of eggs; the latter writer, from the results of an extensive series of experiments upon mice, demonstrates that no external conditions, such as hunger, rich food or poor, age or other factors, can influence the determination. The three memoirs, Lenhossék's, Schultze's, and the writer's, treat of the question independently and from different points of view. Bût they are in complete agreement so far as the fundamental facts are concerned, that underlying the phenomena there are three kinds of functional gametes, and that the actual determination of sex lies with the female Metazoan organism, as she alone differentiates among her germ-cells two forms of functional gametes, the male egg and the female egg. Neither von Lenhossèk nor Schultze enters at all into the discussion of the general questions, which are of extreme morphological and embryological interest and importance, of the nature of hemaphroditism, the phenomena of parthenogenesis, or the universal occurrence of two forms of sperms, or their direct forerunners, in male Metazoa. The former writer, in a short examination of the facts relating to the parthenogenesis of the bee, arrives at conclusions as to their meaning very similar to mine.

Sex in its origin in the Metazoa would appear to have been bound up with the constant differentation of gametes of four categories. These were such that two of them, the female and the male eggs, were formed within a sterilised Metazoan person, the female, while the development of the remaining two, the two kinds of spermatozoa, was allotted to a similar, but not identical person, the male. The gametes of the female, that is, the two forms of eggs, possessed functions different from those of the two kinds of spermatozoa of the male, and for this reason alone a sexual difference between the male and the female was bound to follow.

Of the twofold gametes of the male it is to all appearance rare at the present time to find the full and complete differentiation of both in any given case, but this is known to happen in Paludina vivipara (von Siebold, M. von Brunn, F. Meves), Pygaera bucephala (F. Meves), and a few other instances. In others one form of male gamete undergoes more or less complete suppression in the course of the spermatogenesis, thus in Cicada tibicen (E. V. Wilcox), Bufo calamita (von La Valette St. George), Hyla (von La Valette St George), Bomminator (Ivar Broman), etc., the degree of degeneration varying in different cases. Though never of functional value, unless it take the place of the ordinary form of sperm, the second kind of spermatozoon is probably always represented by something in every Metazoan spermatogenesis, its development must at least be initiated, but it may be arrested anywhere in the history of the spermatogonia or spermolocytes. It has been described by more than a dozen observers in certain members of the following divisions of the animal kingdom: Mollusca, Nemertea, Rotifera, Arthropoda, Amphibia, Aves, and Mammalia, including man himself (in the latter by von La Valette St George, K. von Bardeleben and von Widersperg). In animals belonging to the aforesaid groups its occurrence has been put on record in about 40 species. But all observers agree, that it is never functional.

Holmgren has recorded two kinds of spermatozoa in one of the Coleoptera, and this suggests the inquiry, whether the second form of sperm may not in fact sometimes or often be functional, as well as the usual sperm. The order of Coleopterous insects is very large, embracing not fewer than 70,000 species. The Insecta form an immense group, not less than 250,000 species being known. Probably, in a thousand years, the spermatogenesis of not a tithe of either the Insecta or its order of Coleoptera will have been worked out. This reflection bears significantly upon the question of the relativity of human knowledge. Naturally, we cannot wait another thousand years before drawing our conclusions: we can only say, that in our experience a second form is never functional, and that, though it be very often differentiated, there is no great likelihood of its ever being found to be of functional value alongside the usual form of sperm and in addition to this.

The exceedingly interesting and important recent work of Meves, referred to above, affords additional evidence of the probable truth of this. Meves has studied the spermatogenesis of Paludina in much greater detail than any preceding observer. He records, that in the spermatogenesis of Paludina there is no reduction of chromosomes in the spermatocytes of the worm-like sperm. A most curious irregular reduction takes place in the first of the two ensuing divisions, and the final result is, that each spermatid, resulting from the second mitosis, contains but one chromosome. The normal number of chromosomes in Paludina is, according to Meves, 14 the reduced number 7. Here, therefore, instead of 7 chromosomes each spermatozoon contains but the equivalent of one. In Pygaera, according to the same observer, in the formation of the non-functional form of spermatozoon chromatic material, in other words chromosomes find no place, "in Pyaera the second form of spermatozoon is completely destitute of nuclear portion, that is, it is headless" (Meves). Notwithstanding Meves' cautiously expressed opinion to the contrary, there would appear to be no escape from the conclusion that, even the complete differentiation of the second form of sperm in Paludina and Pygaera being accompanied by phenomena, only diagnostic as degenerative, it can be of no functional import whatever.

When, therefore, it is stated that evidences of degeneration are always to be found in the development of a scond form of sperm, and that these and other evidences, i.e. actual experience, 'always and invariably point to its non-functional nature at the present time, this conclusion is in accord with the strictest canons of scientific investigation. The opposite view would be not only contrary to all experience but, apparently, incapable of proof. "But," it may be asked, "may not some one or other of the 250,000 species of insects possess two forms of functional spermatozoa?" This is exceedingly unlikely, and it would not fit in with the homogeneity of the reproductive processes of the Metazoa as they now exist. One might as well hope to meet with cases in which the polar bodies of oogenesis were normal functional gametes or eggs. Neither contingency is, of course, impossible, only highly improbable, for what has been in the past may, so far as our very limited knowledge and intelligence extend, happen again in the future. Neither occurrence would merge into the miraculous, as is the case with the supposed conversion of males into hermaphrodites. We may neither limit Nature's powers, nor seek to make her perform miracles.

It is the task of the functional spermatozoon to bring about the effects due to the union of two germ-cells of two individualities or sets of characters. Since it is the egg which developes, and not the sperm, the burden of providing for the continuance of the race fall upon the female Metazoon, or, rather, upon the germ-cells, of which it is the host. To carry out this duty the differentiation of twofold gametes, the male eggs and the female eggs, is needful. The germ-cells of the female thus make provision not only for a new batch of female eggs, but also for one of male eggs. On the other hand, the germ-cells of the male only furnish one form of functional gamete. The determination of sex for the next generation thus lies with the germ-cells of the female Metazoan organism.

Under the generally accepted but erroneous view of the existence of only two forms of gametes, eggs and "ordinary" spermatozoa, in the Metazoa but one form of individual can arise. Ordinary hermaphorditism illustrates the truth of this, for here all the individuals arising from the union of such germ-cells are alike. For the constant production of two forms of individuals. three categories of gametes at least are needed. (Figures 8 and 9.)

In all dioecious Metazoa three kinds of functional gametes are constantly required and differentiated; of these two arise in the female, one in the male. (Fig. 8 and 9).

Dioecious and hermaphrodite Metazoa may be defined as animal forms, in which in every sexual individual either two categories of gametes, or the forerunners of such are constantly differentiated. Of these gametes never more than three sorts are functional (dioecious forms), and there may be but two such (some hermaphrodites).

The actual determination of sex is initiated at the division of the primary germ-cells into secondary ones; it is completed at the formation of the oocytes and spermatocytes, and its manifestation is accomplished with the numerical reduction of the chromosomes in these.

While to all appearance the determination of sex would be effected in plants at the formation of the spore-mother-cells*), it does not come about in their equivalents in animals, the primary germ cells; for if one of these undergo independent development alongside the embryo, the result is the bringing forth of identical twins. All known cases of such are of the same sex, and from this it would follow, that all the primary germ-cells of a given case are alike in sexual potentialities as in other respects. All the evidences go to prove that the determination of sex does not take place later than the formation of the oocytes and spermatocytes. The history of the two sorts of eggs of Hydatina senta, Dinophilus gyrociliatus, Phylloxera, and Raja batis, and that of the twofold spermatozoa of Paludina and Pygaera suffice to demonstrate the truth of this.

The faculty of becoming hermaphrodite is confined to the female. The male can only produce spermatozoa, often of two kinds, but only one form of functional gamete. The female produces two kinds of functional eggs, from one of which, the male egg, she is able on occasion by anticipation to form spermatoza. (Fig. 10). In all described cases of hermaphrodite (male) individuals among vertebrates the forerunners of a second form of sperm (spermatogonia or spermatocytes) have been erroneously taken to be "eggs." (Fig. 10.)

Hermaphroditism is associated with the partial or complete suppression of one form of gamete, the male egg; Parthenogenesis, on the other hand, entails the occasional, or the cyclical, arrestment of one or other of the two gametes of the female. If it become acyclical (Weismann), with the consequent disappearance of the males, with these there vanish the male eggs, which produce them, and the spermatozoa. In such instances the only form of gamete left is the

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* A view apparently also held by Strasburger (Biol. Centralbl., Bd. 20, 1900, p. 769).

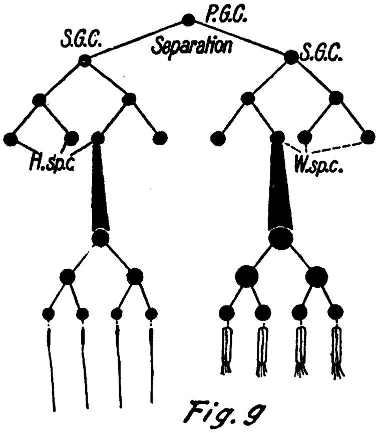

Fig. 9

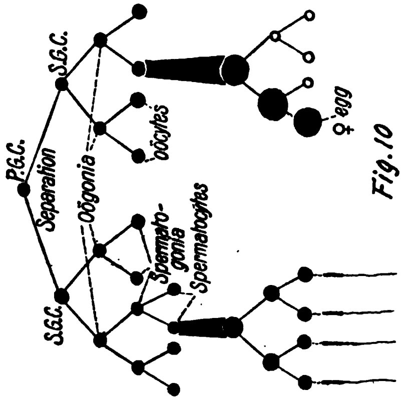

Fig. 10

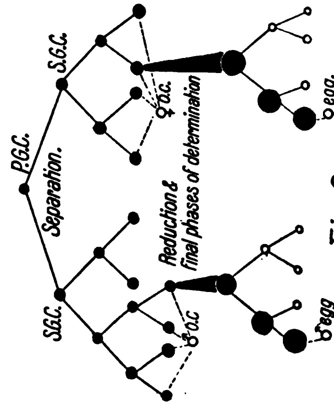

Fig. 8

female egg, which, as is well known, undergoes an isogamous union with a rudimentary sister, the polar body.

Of very great importance for many questions is the recognition that any particular form of gamete may undergo suppression at any period of the life-history; thus, in some instances of the rare production of male persons their occasional reappearance is undoubtedly due to the ommission to suppress one or more of the forerunners of male eggs. Similarly, the rarity or the apparent absence of a second form of spermatozoon in some instances is readily explicable.

Of the problems of sex three aspects stand contrasted: these are its origin, its regulation, and its determination. Of its origin no absolutely certain knowledge is possible: probably it arose from an original isogamy passing into heterogamy of fourfold gametes, thence passing ultimately to the present actual heterogamy of three forms of functional ones, with frequently a fourth but non-functional one.

The experiments of Yung, Born, Maupas, Mrs. Treat and others are often regarded as dealing with the origin of sex during development, or with its determination. In fact these observers have endeavored to regulate it; for they have all started from the erroneous assumption, that the animals used in their experimental researches were either of no predestined sex or humaphrodites. This error completely vitiates their results, which only prove what percentage of either sex will survive under given, usually utterly abnormal, conditions. The recent results of Cuénot and Oskar Schutze completely disprove the possibility of altering or modifying sex during development.

The regulation of sex in nature is, as Hensen and Dusing thought, self-adjusting. Like the determination it lies with the female organisms. The male has as little influence upon its regulation as upon its determination. The total of the females of a race occupy the same position toward the regulation of sex, as the individual female does toward its determination. How the self-regulation is brought into operation is described more fully in the original memoir. The basis of the principle is simply the preponderance of males in the earlier, and of females in the later offspring. An increment in the race is effected by increasing the number of offspring, and with these the number of females. The effect of this begins to manifest itself in the third generation.

All interference with, or alternation of, the determination of a sex, is apparently absolutely beyond human power. To hope ever to influence or modify its manifestations would be not less futile and vain than to imagine it possible for man to breathe the breath of life into inanimate matter.

For the workings of Nature in sex merge in her revelations of Life itself.

Fig. 8.—Oogenesisand determination of sex in Raja batis.

Fig. 9.—Prohable course of spermatogenesis in Paludina (after the statements of F. Meves.)

Fig. 10.—Supposed course of oogenesis and spermatogenesis in hermaphroditism.

VI. COMPARISON OF THE LIFE-CYCLES OF THE HIGHER ANIMALS AND PLANTS.

The theory of an antithetic alternation of generations as the basis of Metazoan development postulates something resembling the formation of spore-mother-cells in plants. It is clear that the reduction of chromosomes has been deferred to a later portion of the life-cycle in the Metazoa as compared with plants; and this fact was insisted upon by J. A. Murray and the writer in 1895. At that time we compared the two modes of development together in tabular form, and we postulated the formation of the embryo in animals upon the asexual generation or phorozoon from a spore-mother-cell. Certain facts supporting this view were cited, including E. B. Wilson's "teloblasts"[*] of the earthworm, which must be derivable from a single cell. Finally, the missing "spore-mother-cells" have appeared in the primary germ-cells.

Revised Comparison of Metazoan and Metaphytic Life-Cycles.

	Metazoon.	*Metaphyte.*	
Asexual Generation.	Zygote (2n).	Zygote (2n).	Asexual Generation.
	Phorozoon (2n).	Sporophyte (2n).	
	Formation of primitive germ-cell (2n).	Formation of primitive spore-mother-cell (2n).	
	Formation of primary germ-cells (2n).	Formation of spore-mother-cell (2n)—reduction and? determination of sex.	
	"Apospory" (reduction postponed).	Spore-formation.	

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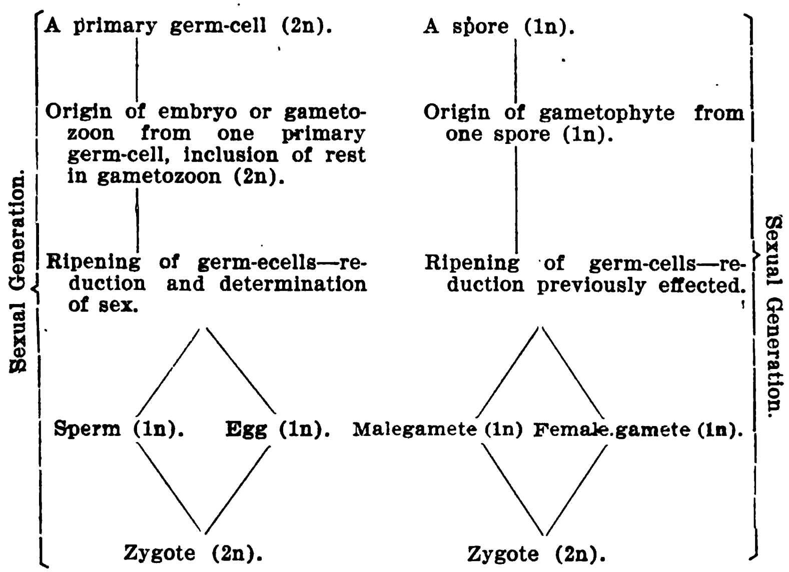
[*] These are a few large cells, comparable to the two cells m of Fig. 7. They proliferate chains or bands of cells destined to form various parts of the worm within the larva. Excellent figures of them will be found in Wilson's "The Cell," 2nd ed., 1900, p. 374, Fig. 175.


Sexual Generation.
A primary germ-cell (2n).
Origin of embryo or gametozoon from one primary germ-cell, inclusion of rest in gametozoon (2n).
Ripening of germ-ecells—reduction and determination of sex.
Sperm (1n).
Egg (1n).
Zygote (2n).
A spore (1n).
Origin of gametophyte from one spore (1n).
Ripening of germ-cells—reduction previously effected.
Malegamete (1n)
Female.gamete (1n).
Zygote (2n).
Sexual Generation.

In the above table "n" equals the number of chromosomes prior to the duplication, "2n" at conjugation, that is, fertilisation.

In 1895 the writer was not sufficiently sanguine to believe it possible that at present the embryo or sexual generation would be found to arise from such a spore-mother-cell in any instance. Only its formation at some time in the past from a spore-mother-cell was spoken of, because the facts of development at that time known seemed to point to its origin from at least a few cells. And, moreover, everything then seemed to go to prove the production of the "sexual organs," the germ-cells, by the embryo itself.* Such was the belief of almost every embryologist, and there appeared little or no reason for doubting its correctness. The effect of these two factors was to bar further progress in that direction, at any rate for a time. In face of the apparent facts, I confess that it was impossible to foresee how the formation of the spore-mother-cell was effected. Moreover, there was not the slightest suspicion in Murray's mind or in mine, that the germ-cells had anything to do with the matter.

It is possibly a humiliating confession to make, but it is true, that I was never able to conceive how Nature could carry out this formation of a spore-mother-cell, until my researches had revealed how she really accomplished it. No one could have been more astonished than the writer at the revelation. Never for a moment had it been imagined that the germ-cells themselves would play the part they actually do in the life-drama of an antithetic alternation of generations. Only when the first portion of the work was practically complete and ready for publication, was it seen that the missing link in the alternation had at length been discovered in the primary germ-cells and in the epoch of their formation. I hardly feel called upon to prove that the primary germ-cells do represent spore-mother-cells; it is so obvious. Were each of them to undergo a reduction with the subsequent production of four "spores," and were then each animal spore to develop into an organism, we should have the exact equivalent of the gametophyte of one of the higher plants. Instead, thereof, they remain together, and, as a rule, only one becomes sterilised to form a sexual individual or gametozoon (to contain the remainder). Their remaining together, and the continued and progressive amplification of the gametozoon in course of ages, have naturally deferred their ripenings, sex determinations, and reductions to later and later periods. It is obvious that this could easily be effected by starving them, but this may not have been Nature's method of delaying their ripenings.

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* That is to say, from the germinual epithelium of Waldeyer, and as so derived there was a somatic origin, not a morphological continuity. Between 1895 and 1900, nothing occurred to alter embryological opinion. At the close of 1900, when the words in the text were originally written, the first account of researches upon the germ-cells of Raja was published. These facts throw light on the question of the priority of the discovery of a morphological continuity of germ-cells, which by Waldeyer is now assigned to Boveri and Weismann, wnose published researches really demonstrate no continuity of germ-cells whatever.

In the higher plants it is the spores, whose name is legion; while the "sexual cells," eggs and sperms, are few and far between. In animals the "sexual cells" exhibit the reverse condition, corresponding in their multitude to the spores of plants; while, as we at length know, the spore-mother-cells—there are no spores in the Metazoa—are not very numerous,* being represented in some cases by but one cell in addition to that which forms the sexual generation.

Why this difference? In the embryo-sac of Pinus, which is the gametophyte, there are only four germ-cells. In the corresponding structure in flowering plants there are perhaps three, or at most six or eight; while, as is well known, the male gametophyte of a flowering plant is represented by one or two vegetative cells and one or two germ-cells. No Metazoan sexual generation has so small and scant an endowment as these; while such an animal may contain and harbour a number of germ-cells thousands of times greater. The difference is doubtless partially due to the different procedure adopted at the formation of the primary germ-cells or spore-mother-cells. The plan carried out in animals has been such as to favour the ever greater and greater amplification of the sexual generation. In plants, as elsewhere already insisted, the reverse is the case. Here the asexual generation has undergone increased amplification without ever being able to attain to any very high degree of histological differentiation. The sexual generation of plants is at the best a miserable failure form the morphological point of view, and this must be set down to the factors indicated, and still more to others to be yet described. The higher one ascends, the smaller it becomes, until, in the highest flowering plants, it has almost reached the vanishing point, without, however, being able to disappear entirely.

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* Seeing that the original primary germ-cells, whatever be their number, at later periods undergo many divisions, and that apparently this number can perhaps with the course of time and on occasion be still further added to, it might seem to be a matter of no consequence whether the number of primary germ-cells was, for instance, 2 or 512. The meaning of the observed differences in the number is, to some extent, bound up with the origin of the mode of the development.

In animals it is the phorozoon or asexual generation which makes the bravest show in the lower Metazoa; but even here it is usually overshadowed in degree of morphological differentiation by the embryo or sexual generation. In the higher forms it becomes reduced; but, like the rudimentary sexual generation of the higher plants, it cannot vanish, for it also has its assigned task in the reproductive round. The sexual generation or gametozoon, thanks to the importance of the precious cargo of germ-cells which it carries, has received the kindly attentions of Nature, with consequent higher and higher evolution. From a variety of causes the phorozoon, on the other hand, tends to simplification the higher one ascends. At the best, its organisation is simple, but this simplicity leans even to meagreness in the vertebrata as they now exist, and in the mammalian chorion or trophoblast the phorozoon has reached the lowest depths of degeneracy, for its structure is almost devoid of histological differentiation.

(Continued in July Number, 1905.)

matter of detail. There is no real problem in the education of the blind distinct from the education of the seeing; the condition is merely one of detail. If we were to go into Mr. Smead's school to-day, we could see a class of children learning to read, just as they are learning in the public schools in the primary departments, in the City of Columbus. They are reaching their goal in an equally intelligent manner as do the seeing.

I wish that all could remember, that in speaking of the blind there are really three school classes that might be mentioned roughly, which we realize in our school work, and which the people outside of school work do not realize that blindness covers all grades of society—from the blind Prince over in Germany, or the blind professor here in Dubuque, down to the beggar on the street. There are three classes, first, the charitable. Now, they ought not to be put in an institution for the blind—the sick, helpless and infirm do not belong there. There is no problem in connection with that charitable class that is not common everywhere. They should be treated just as seeing people of that same class. There is another class which we might call the industrial class. This is made up largely of unfortunate men and women, people who have lost their sight after reaching adult age; they, however, do the best they can.

It is the province of the schools for the blind to shape these people for their new conditions, and if possible, to create new conditions; to create a proper environment for these people; this is a part of the work of the school for the blind. It is a great pity that we in this work have not the ability, or the money and the time to go out through the world and reach people about this matter. I feel sure that in these restaurants here blind girls could be utilized for washing dishes. An intelligent blind girl would make an excellent person for that kind of work, if the dishes were brought to her and set down on a table like this, and some one take them away. But nobody seems to be willing to take the time; nobody seems to be willing to combine business with that claim these people have on us. No person who knows me would accuse me of being a business man, but I feel confident I could run a broom shop and employ an intelligent seeing man as foreman, and then introduce into that shop able-bodied blind men, and the shop would pay expenses. I am inclined to believe, however, that such an institution could not succeed if managed by the state, for the reason that it must be managed in a bureaucratic manner, in order that everything may be accounted for; but in a private enterprise that could be eliminated, and the one managing could control all, and if he failed to pay expenses, close the shop. That class of men and women deserve our earnest attention.

The happy blind person is a person who feels that he is a unit in our system of society; who has an interest in his town or community; whose vote counts, and who is counselled on little matters of community policy, and who has a business that brings him in a living—such a man is the happiest man in the world, and the girl who can do that is the best girl in the world. You may build these great institutions, and you may surround the blind with every luxury; they take all you can give them and be ungrateful for it. The reason industrial homes have been unsuccessful, is that they have been really asylums; there was no hope beyond; there was nothing to lead to a future, so human nature would not exert itself.

Now then, when the educators of the blind speak of the blind, they really mean the class that can be educated. We received into the institution just two weeks ago a little boy 8 years of age, a healthy strong boy; his sight is gone. That little fellow has learned his letters down to m and has made a bead basket or two; he is just as smart as a whip. Now then, our work is to fit that boy for his place in the world, whatever that place is. And so, there is a great work before the schools for the blind. They will eliminate that charitable class; they have done that now; they will eliminate more and more this industrial class and admit only the able-bodied and intelligent, and the unworthy they will not admit at all. We want the class that is desirous of being educated and of becoming useful members of society. The weak minded should be sent to schools for their special benefit. The vicious should be sent to people who are prepared to handle that class, and only the wide-awake, moral and intelligent people should be retained in these institutions for the blind.

Mr. Smead spoke about a high school teacher within a few miles of Columbus who actually did not know that the institution was for educational purposes. I received the other day a letter from a lawyer in the southern part of the state, asking me if we could admit a baby ten months old. I would not have been surprised at that if his letter had not betrayed the fact that he didn't know why the institution was in existence. It seems impossible to educate the people. We sent out 17,000 circulars last summer in three months, to the citizens, rank and file of the state, wherever we could find a name, and we expect to do that every year and have done it for some time.

It seems to me if any class of people should be grateful, those who are in the work for the blind, the blind themselves should be. The money is poured out lavishly, but I wish sometimes the men who were instrumental in doing this, wouldn't treat us in such a patronizing manner. Men will say, we give the blind this, because we want to. That doesn't meet a want. You give to the blind just what is needed and no more, and you expect the blind to utilize that and you give it because it is right and that they should be recognized and have the benefits of an education; that is the only reason. It is very common for public men to show a disposition, when they come to the College for the Blind, to grant to the blind what they wouldn't give to the seeing boys and girls. That is a mistake. We, in this work, realize, to make the blind successful and happy, they must be of the same disciples, they must study just as hard, they must be under just as severe conditions as the seeing boys and girls in other schools, and as they become accustomed to that, they like it.

Member Cownie: I would like to ask Mr. Smead a few questions in regard to the institution over which he is Superintendent in Ohio: How many pupils do you have, Mr. Smead?

Superintendent Smead: We have enrolled 320 at this time, since September; probably 305 or 306 at the present time.

Member Cownie: How many teachers do you employ?

Superintendent Smead: Twenty-seven in all is the number, counting everybody, music and industrial.

Member Cownie: What proportion of your teachers are seeing and what proportion are blind?

Superintendent Smead: The music teachers are all blind except one, and there is one literary teacher who is blind; there are ten literary teachers. I should have to stop and count. About one-third; I should think a little more than one-third of the teachers are blind.

Member Cownie: In your experience in the management of the Ohio Institution, do you think it wise to employ blind teachers for literary classes?

Superintendent Smead: I think we have got to the full limit of the employment of blind teachers. I believe in employing some blind teachers, and I think they should be in very small minority. Even in music a blind teacher cannot do what a seeing teacher ought to do. Still we supposed that was the field for the blind, if we employed any blind teachers.

Member Cownie: No doubt our sympathies run in the direction of employing blind teachers. It has been a question in my mind, in visiting our College for the Blind at Vinton and going from room to room, whether there might not be a good many things going on in the school room, where there is a blind teacher, that would not be tolerated if the teacher was a seeing person.

Superintendent Smead: Yes, sir; that is true. The question of discipline is a difficult one for the blind teacher. The blind teacher in our literary class succeeds perhaps better, but one of our music teachers who has quite a large number of children in the choir, finds it exceedingly difficult to control them.

Member Cownie: Is it not a fact where the two sexes are in the same school room and occupy adjoining seats, that the boys might be guilty of conduct where a blind teacher is in charge, that would not be tolerated by a seeing teacher?

Superintendent Smead: Yes, sir; there is that liability.

Member Cownie: Is it not a fact that the seeing teacher is better qualified to give oral instruction, to which you so ably referred.

Superintendent Smead: Yes, sir. This gentleman in the literary department I referred to is quite a superior man; he employs a reader to prepare him for his studies; but he is an exception; it illustrates what a blind man can do.

Member Cownie: I was particularly pleased with Mr. Smead's paper, and I am still more gratified now to find that he and I think alike on the question of employing blind people as teachers.

Superintendent Rothert: I have an idea that I am not doing my duty as a member of this Conference if I do not thus publicly declare that of the many papers that have been read since I have been a member of this Conference, no one paper has come closer to me; no one paper has been better understood by me; no one paper with changes that I might make in the wording, represents my thoughts, than does the excellent paper read by Mr. Smead. The title alone interested me specially, from the fact, not knowing what is was to be, this morning, in a social way, I mentioned the fact that I objected to have my institution called an asylum.

I am glad there is a voice in this state that comes from the great state of Ohio, my native state, that fully endorses the position that the Superintendents of these two sister schools, the School for the Deaf and the College for the Blind have taken and occupied for years in this state; that these institutions are simply and purely educational institutions, and not charitable institutions in any manner, shape or form. I say, I am especially happy that this comes from the great state of Ohio, and that in that state they would recognize and endorse this thought, this right that the deaf and blind have to an education. If we recognize the rights of these children to an education, we as a state are bound to provide for that education; if we recognize that they have similar rights to the hearing and seeing, we must extend to them the same privilege. Now, in the education of our seeing and hearing children we divide the state into districts; we have superintendents, boards of trustees, principals of schools, teachers, etc. We have the same with the blind and deaf, with this one addition only, that we feed them. We do not clothe our children, of the institution for the blind or that of the deaf at the expense of the state. We doin fact at the expense of the county, where the parents are too poor to defray the expense. Now then, if this matter of feeding the children is the only addition, if we were to divide the state of Iowa into 20 districts for the deaf and 10 districts for the blind, and add so many superintendents, principals and teachers, in connection with ten or 20 different institutions, it would cost the state of Iowa a great deal more money than the support of these children in these two institutions.

It is a source of a great deal of trouble, Mr. Chairman, and a source of still more regret, that it seems to be impossible to educate the public to a true idea of the mission of these two sister schools. It seems to be impossible to impress upon the minds of people that these institutions are not asylums; are not places of refuge; are not hospitals; I dare say, that while we are trying to educate this generation, those that follow us will have the same trouble in the generations to come. So little seems to be understood with reference to the deaf and the blind in this state—and it appears from the paper just read, that this condition exists in the state of Ohio, and no doubt, it exists everywhere, and notwithstanding the strenuous exertions we make, as referred to by Superintendent McCune, it does seem as if there is but little interest manifested in the education of these unfortunate people. I cannot give the reason why; notwithstanding it is a fact, and it is principally so with the people in authority. Outside of this Board of Control, by their visitations, by their interests, and by their repeated investigations, which is fully cognizant of what we are doing, outside of this official board, I dare say, there are few people in Iowa that occupy public position, who know very much about what Brother McCune is doing at Vinton, or what the School for the Deaf is doing at Council Bluffs.

During the last session of the General Assembly I had occasion to send to every member of that body a little pamphlet on compulsory education of the defective classes, and I accompanied that with a request, a written letter, typewritten letter—I spent a good deal of time, because I was interested—requesting to kindly peruse as far as convenient, endeavoring to secure some legislative action. I received one reply as an answer to the 150 letters I sent. I received no reply from the Committee to whom that matter had been referred indirectly, and who had charge of the educational matters of the state.

Now, we propose to go on in this good work; we propose to keep on endeavoring to educate the people of this commonwealth, that there are two schools in this state, which, under the management of this Board of Control, are doing everything in their power to help build up, help to educate, to develop the mental resources of these defective children, and are endeavoring to make them good honorable, moral citizens. We are endeavoring to build up these germs of intelligence in such a shape, that when they go to their various homes they are an honor to the family from which they hail and a credit to the community in whcih they live; and I want to say in all kindness and all modesty, that we have a right to expect some little approbation, some little encouragement for the work we are doing. We have a right, Mr. Chairman, to expect, when legislators pass through the city of Vinton or the City of Council Bluffs, that they will take the trouble to come and see how the money of the state is expended, and what we are doing for these unfortunate human beings, and whether the work we are doing under your supervision is well done, and whether the results we are endeavoring to show are accepted. But I dare say, we are so unfortunate as to meet with very few who will encourage us, help us, who will assist us in that direction. I have had more encouragement, more help, more assistance in the last six years under this Board of Control, than I have had under the twelve years of our trustee system. I have been in closer contact with authority whose approval I cared for, in the last six years, than I was under the twelve, when it was merely an institution managed by a few, who apparently had no further interest in the success of the work, save and except the fact, that they were trustees of the institution and considered such a position an honor.

I beg for more interest; I beg for more encouragement; I beg for more help; I beg for more intelligent knowledge of these two sister schools, and I have no doubt as to the result. I have no question whatever, that if we could throw open our doors to the citizens of Iowa, could look in and see what Superintendent McCune and his teachers are doing, see what is being done in Council Bluffs, as you, gentlemen of the Board of Control see it, I have no doubt, but that all the help, financial, that is necessary to make the blind and the deaf children moral, intelligent and good citizens, will be freely offered.

Judge Kinne: I want to say, I greatly appreciated the paper. I think I voice the sentiment of all when I say, we are very much pleased at his being here and giving us his most excellent paper. Superintendent Rothert, in his discussion of this paper has brought out one thing,—though it may be strictly germane to the paper, but propably grows out of it,—that people do not take the pains to advise themselves of what is done at the state institutions. That is altogether too true. I have studied that thought a great deal. Whenever I visit an institution, if I can get a good man who has sense and intelligence to go along, I always try to get him to go; I want him to learn something and spread the Gospel, as it were. But it is a fact, that under our system of government people think, we furnish the money, we are not concerned; of course, we pay the donation and the legislature meets and doles it out here and there, wherever they think best; that as individuals we citizens do not concern ourselves about it, unless we have a child or person who comes within some one of these classes.

I think I may say that one of the best things that has resulted, in this state at least, from the Board of Control system, has been, that the citizens of our state are better acquainted to-day with the work done at the institutions, with what they are for, what they are trying to accomplish, than ever in the whole history of the state, from the simple fact that everything proper for the public to know is given to them; there is no object in concealing it. Every day there are from three to four newspaper men in this office, and if there is anything of the slightest interest to the public, it is given to them. If they are not advised in a cursory way as to what is going on, it is their fault. That never was done before, because under the other system, each institution was a unit by itself. But the people are becoming more intelligent in that respect and they are taking more interest in it than they used to. Of course, there are many people who would like to inform themselves, but with many of us it is a struggle for life; thousands of men would like to, but cannot. Other men are indifferent; they say it is not their business; they pay the taxes, and that ought to end their responsibility.

The Chairman: We pass to the next paper, on the subject of "The Adulteration of Food and Medicine", by H. P. Duffield, M. D., Surgeon Iowa Soldiers' Home. There seems to be a wide impression abroad, that between microbes of various kinds and the adulteration of foods, the average citizen has a hard time of it. So far as food and medicine is concerned Doctor Duffield has had an excellent opportunity to make this subject a study, and we will now listen to his paper. The paper will be found on page 145.

The Chairman: Can we have something just as good from some of the doctors? The paper is open for discussion.

Judge Kinne: Before the doctors speak, I want to call attention to a matter or two in connection with this paper. Perhaps a couple of years ago a sort of a protest was made against some sellers of articles to the institutions, that certain other gentlemen were not furnishing pure goods in their line, spices, mustards, and so on. A test was made in the room across the hall here, and it developed that out of all the persons bidding on those particular lines,—some, 8 or 10, there were only two of the samples submitted genuine, and several of those samples had no relation to what they purported to be.

I hold in my hand, a report from the North Dakota Experiment Station. They have one of the best pure food laws in the country.

You will take up your paper this evening as you go over to the hotel—I assume it is still in there—and you will see a half or two-third page advertisement about Peruna, that elegant medicine, supposed to cure everything on earth. Now, it is wonderful, the number of people that use Peruna. I believe from my slight knowledge and acquaintance along that line, most people wouldn't think of drinking anything supposed to have any stimulant in it. Yet, as shown here by this report from North Dakota, Peruna only has 25 90-100 per cent. of alcohol in it, only a little over one-fourth of it. People are all drinking it for the alcohol in it; they get a little stimulant out of it and they think it is doing a world of good. If you would accuse them of drinking alcohol, they would resent it at once. This report contains a vast amount of information about the investigation and analysis made of various articles and among other things, groceries especially and meats, and they fully corroborate all that the doctor has said here and a good deal more, because this is a very large subject. Strawberries, which never saw a berry or a part of one are put up in jams and jells, and tomato catsup—I think I saw some of my friends eating it over at dinner—and so it goes all through the whole line. Prof. Heath says that he examined in North Dakota a great many speciments of potted ham and potted chickens or turkey. He says he never found anything more than just a trace of it. Now, as long as there are people who are willing to make merchandise out of these things, and people are willing to buy them without investigation, so long it will go on until we get proper and rigid legislation which will drive those people out of the state, as in North Dakota. I think, after a thorough exposition of this subject, the gentlemen representing the institutions will do as Superintendent Witte does, make your own catsup.

Member Cownie: I wish to corroborate what Member Kinne has stated in regard to ground spices purchased under the estimates made by the representative superintendents of our state institutions. We know that they are not only adulterated with cheaper articles, but we also know that they contain very little of the article that was desired. We have urged, time and again, upon superintendents of our state institutions to estimate for whole spices, as the opportunity for adulteration is far less than in the ground article. Many of you, at least are aware that you positively refused to accept unground pepper, because it would involve a little labor to turn the handle of a mill to grind it yourselves. I am speaking now plainly, for we have had superintendents write to the Board that they could not use unground pepper; they must have it ground; they couldn't use unground spices; they must have them ground; notwithstanding the fact, as Dr. Duffield has shown in his paper, that all these ground spices are practically adulterated. I would not use them; I would not purchase them; I would have nothing at all to do with them, and there is no excuse for the state institutions purchasing articles of that kind.

We have estimates for plum jelly, plum butter, apple butter, and we have representatives from some of the largest grocery houses in the west tell us, that the very best quality of that plum butter was made from pumpkins and acids; and yet in the face of that, superintendents of institutions will estimate and purchase such articles. It is surprising to me, that superintendents—and some of them physicians—would buy such articles for use in state hospitals.

America has become the dumping ground for Europe, for shoddy. The sale of shoddy and its manufacture is in a large number of the countries of Europe is absolutely prohibited. It is shipped to this country; it is used in the manufacture of blankets with a cotton warp, in preference to the genuine article, because it is said to be stronger. It is not stronger. It is not as strong, as can be demonstrated and certified to by superintendents of institutions who do not have a shoddy blanket in the institution. For one, I am opposed to the purchase of those shoddy articles.

We have these breakfast foods, largely advertised, put up in a nice pasteboard case, and a fine chromo. The best grains cost about a cent and a half a pound; when they come to us as breakfast food, they are ten or fifteen cents a pound. We have substituted for coffee and the best can be said of them, is that they are simply a cereal roasted like coffee; yet there is not one cereal that costs over two cents a pound, and when they come back to us as a substitute for coffee, they cost 18 cents a pound. We have superintendents who will estimate and purchase those goods. I do not say they are unhealthful; but if you are determined to use a cereal, why not roast your own barley and rye, as we did when coffee was worth a dollar a pound? Why give this great profit to some one who is shrewd enought to put an article on the market for ten cents, that costs him a penny?

I believe the time has come when Superintendents should take to heart the recommendations made by Dr. Duffield and eliminate those articles that we know are liable to be adulterated from the dietary. We are offered sausage at less than the price of live hogs on the Chicago market. Do you expect choice meat at these prices? Do you suppose these packers are running their business for their health. When the scrap and refuse meat of a packing house are ground together, highly seasoned with strong spices, and converted into sausage or bologna—it is delicious; it is fine; we are told our people like it— they would not enjoy it if I had the preparation of the bill of fare, for I would absolutely prohibit such foods in state institutions. When you purchase meat on the carcass you know what you are getting. When I go to a hotel, one dish I never touch, is hash. The steak may be tough, but if I get a slice cut from the carcass, I have at least some idea what it is composed of. After it goes through the grinding mill and comes back as hash, I do not know what it is, nor where it has been.

As I said before, I sincerely hope our superintendents will ponder and think over the recommendations made by Dr. Duffield, and that in the future no more estimates will come to this Board for articles we know are largely adulterated; that you will confine your purchases to articles that you know are pure and healthful, that the health and lives of those entrusted to our care, may not be endangered by the use of adulterated articles served as food.

Superintendent Witte: I simply wish to express my appreciation of Dr. Duffield's most excellent paper, and say one word in regard to medicine, being the one thing, perhaps, I am more critical on than any other. I am simply uttering a truism, when I say, when we do need medicine, we need medicine. In my own practice I do not rashly resort to medicine, and look rather upon it as a last resort. When you do need it, you want the real thing, and the contemptible scoundrel who will put adulteration into medicine, is on the same plane as the man who put iron into cork of a life preserver. We should patronize only such people as will furnish us what we want. We only require medicine on rare occasions, but when we do need it, it is not a matter of filling up the stomach, which is perhaps not injurious, but perhaps something on which life may depend. I feel very deeply on that one point.

The Chairman: The next paper is entitled, "Our Industrial Schools," by Mr. Cownie, Member of the Board of Control.

Mr. Cownie: When I chose the subject for the paper to be presented to this Conference, I thought I knew a good deal in regard to conditions at our Industrial Schools, and that I would be able to prepare a paper based on an experience of nearly seven years in dealing with the boys and girls of these schools, and endeavoring to find homes and employment for the graduates of these institutions. But desiring to better qualify myself for the preparation of the paper, I began correspondence with a number of leading states in our Union, making inquiries in regard to points about which I had some doubt, and the more I have investigated this matter, the more I became convinced, there was still much to learn in regard to the proper methods of conducting these reformatory schools; not only in our own state, but in nearly every state with which I have corresponded, I find there is still great room for improvement in the management of these institutions in other states, as well as in our own. I had also expected to present in this paper the relative cost of supporting the boys at our Industrial School at Eldora, and the girls at our Industrial School at Mitchellville, and compare the cost in Iowa with that of other states. I have received a number of replies to my inquiries and I find, while a few have a less per capita allowance than we have in Iowa, a great majority indicate a per capita much larger; reaching in some states $250 per capita per annum, while we have less than $150 per capita. I also expected to find accurate figures in regard to the birth rate in Iowa during the year 1904, and to ascertain the percentage of boys and girls committed to our Industrial Schools, in comparison with the whole number of children born in the state. I was somewhat surprised to learn from the Secretary of our Board of Health, Dr. Kennedy, that from all the information he had secured, the deaths last year in Iowa outnumbered the births. No one would believe such a statement and it is apparent that the deaths are reported, while the births are not. It will be necessary to get more definite information before any computation could be made in regard to this matter.

My object in writing the paper was two-fold,—primarily that it might be brought to the attention of our legislators, and a comparison made of the actual cost of sustaining our industrial schools and the benefit secured to the state in comparison with other educational institutions. As I have stated before, the more I investigated, the more I found that there was yet much to learn, and for that reason, with your permission, I would prefer not to present my paper until the next conference, when I expect to be more fully informed in regard to this important subject, and as the legislature will not meet until next winter, it will then be in ample time, and perhaps serve a better purpose than if I were to present it now.

The Chairman: I will name as a Committee on Program for the next meeting, Superintendents Rothert, Voldeng and Fitzgerald.

(The Conference adjourned until 9 o'clock A. M., Wednesday, March 22, 1905.)

WEDNESDAY FORENOON SESSION.

The Chairman: We will open the program this morning with a paper, entitled, "The Influence of Massage in the Treatment of Mental and Nervous Diseases," by N. M. Voldeng,, M. D., Superintendent Cherokee Hospital. The paper will be found on page 156.

The Chairman: The paper is now open for discussion.

Superintendent Smead: How much medical knowledge is necessary to the practice of this profession, anatomy, etc.?

Superintendent Voldeng: I think that a thorough knowledge of Anatomy and Physiology is absolutely essential to the rational and successful use of it.

Superintendent Smead: As a profession for the blind, what do you think of it? The question has come up with us. In Japan, I understand that the blind do practice this profession.

Superintendent Voldeng: There is no reason why a blind person could not become very efficient.

Superintendent Witte: I desire to commend Dr. Voldeng's most excellent paper and briefly refer to something of the modus operandi of massage.

We are all agreed as to the beneficence of massage in the healing of diseased conditions, and as has been indicated in the paper, it is deplorable that more use is not made of it. The principles underlying the use of massage, or rather its fixed physiological effects, are two-fold. As has been indicated in the paper, they are, first, physical and have for its object increased metabalism or tissue changes in the diseased part, and it does this primarily by favoring return circulation and thereby particularly favors the return of venous blood. In the make-up of our bodily mechanism, the veins are our weak part. The arteries have a strong central force pump back of them to drive the blood to the extremities and all parts, but in the veins, the return of this blood is rather of a passive character; there is some force from behind, and to that is added a system of valves which favor a forward motion and prevent a return in the veins; muscular action aids to drive this current forward. There is, as has been suggested, in massage, a stimulus to the nervous system; enervation is increased by those movements. But equal to this physical effect in importance, and perhaps in some cases more so, is the mental effect. We excite, by massage, and direct expectant attention. In other words, it acts upon the suggestive principle, which in itself directs more blood to the part. The patient's attention is drawn to it voluntarily or involuntarily by suggestion, and the enervation and circulation of the part is improved, and as has been suggested by the paper, the effects on mental diseases as well as general disorders cannot be easily over-estimated. Of course, there are certain conditions in which massage can be harmful, and that is for the experienced and educated physician to determine.

While I agree with Superintendent Voldeng perfectly, that for an ordinary masseur it is necessary only to have a good working knowledge of anatomy and physiology, for directing massage something more is essential, and whoever undertakes massage, must either possess that or else be directed by somebody who is in possession of such knowledge.

Superintendent Voldeng: What do you mean by that?

Superintendent Witte: I wouldn't turn a man who simply knows anatomy and physiology loose on an acute affection, without any training.

Superintendent Applegate: I do not think I can add anything of consequence to Superintendent Voldeng's paper; but a few thoughts have occurred to me while he was reading his paper. There seems to be in a considerable massage work done in some of our state hospitals, especially at the Clarinda State Hospital. We found in our experience with Masseurs that we had very beneficial results from massage work when properly given. We have also had some detrimental effects. We found, as to some of our patients that massage had a stimulating effect and on others it had a soothing effect. All people cannot be given massage alike, and the masseur and the physician will be called upon to determine the kind of massage and the extent it should be given. It is my understanding, that in the days of the gladiators, the annointing by oils by the slaves was not so much for the odors emenating from it, but from the good effects of the massage or rubbing. The gladiators before fighting would be annointed with oils and after the fight they would be soothed by different massage, the slaves being trained to give massage in a proper way.

At this time massage is being used a great deal with patients suffering from constipation, and people generally have gone to the osteopaths and to the physician giving massage for these troubles. I think a great deal of the reputation given to osteopaths through massage has come from this sort of treatment for constipation, neurasthenic patients or hypochondriacal patients. It certainly has a good mental effect, not only on the normal person but on diseased minds of our insane patients. It is well known that massage relieves pain, whether in the chest, abdomen or whether it be from rheumatism or headache. In applying camphor for headaches, usually more effect is derived from the rubbing or massage of the scalp than from the local application of the camphor.

I know that great good can be done in our institutions for the insane by the use of proper massage, but it is very difficult to get good masseurs. It is my understanding, as one gentleman here has said, in Japan the blind are practical and efficient masseurs. It seems to me that would be a great field for our blind people, if they are physically able to give it in a proper way. Some masseurs have the ability but have not the proper physical strength back of it to give proper massage. The practice of calisthenics is along this line, and massage with calisthenics would certainly be a great addition and help to our medical people in our hospitals for the insane.

Superintendent McCune: One of our old pupils took a course at Kirksville, passed through, graduated and has a very successful practice in the south part of the state. Another in the western part of the state graduated there, and I understand he is doing well. A third young man I understand is now taking the course in the College at Des Moines.

Superintendent Smead: Are these gentlemen or ladies?

Superintendent McCune: Gentlemen.

Superintendent Crumbacker: I want to attest my appreciation of Superintendent Voldeng's paper. I thought it an excellent paper on the subject concerning which it treats. The matter is one of considerable importance to us in our work in the hospitals for the insane. I have never seen very much work done along these lines in the hospital for the insane. I have never been able to institute it to anything like the extent I feel it ought to be instituted. In the first place, we find very great difficulty in obtaining the service of people who can do this work properly.

As to the educational qualifications necessary to do this work, I think that a course in anatomy and physiology, as we are attempting to give our nurses in the hospitals in this state would prove sufficient to make good masseurs of them. By that I mean, masseurs under the direction of a competent physician. I think this work should almost in all instances be carried out under the direction, advice and prescription of the physician and competent nurses.

The blind, it appears to me, could learn to do this work quite well, as the avenues open to them for employment are not nearly so great as for other persons. I see no reason why many of them should not be profitably engaged in this work.

The physiological reasons for massage, of course, are very many. It has become the custom, especially in treating cases of Neurasthenia, to institute what is known as Mitchell's Rest Cure. In carrying out that cure, the patient is put to bed and not allowed to exercise; they are fed very liberally, milk and eggs, the idea being to allow the nerve centers to recuperate from the exhaustion which is in most instances the result of over-exertion. It appears to allow these nerve centers to recuperate, absolute rest of mind and body, both are necessary. But we all know what the effect of absolute rest is likely to be. The muscles from disuse become atrophied, the bowels become constipated—the patients digestive apparatus is entirely out of order; for a little while the patient is unable to take liberal quantities of food, and this is the objection or obstacle in the way of this cure. He later on decided to make up in a manner for the loss of muscular function by the use of massage, and by allowing the patient to lie in bed would have a competent person one or two times a day give these treatments, and which proved to be most valuable; the muscles were kept from atrophying. Massage takes the place of exercise and work, so that it has been found a very valuable adjunct in the treatment, especially, of these cases of neurasthenia. The same thing is true of all forms of paralysis and paresis. The patient being unable from the condition of the nerves to institute and keep up exercise, and the muscles and other tissues as well become atrophied. But in a great many instances, if by massage the muscles can be kept from dwindling away, the nervous condition in time is restored, and in these cases great good comes from the use of massage.

It is true that in minor ailments the use of massage is very beneficial, and pains of all kinds are favorably influenced. There is not a physician here but who knows that time and again he has prescribed ointments or liniments for neuralgia and other pains; his directions have been to have that thoroughly rubbed, even going to the extent of stating how long that shall be rubbed in, and he has intended to get more good from the manipulation, the massage, as we might term it, than from the medicine he has prescribed, knowing, however, without medicine the directions would not be carried out.

The Chairman: The last paper is entitled, "Classification of Insane Conditions," by Max E. Witte, Superintendent

State Hospital, at Clarinda. The paper will be found on page 164.

The Chairman: The paper is before you for discussion.

Judge Kinne: I do not imagine that I know enough to discuss this paper. I want to refer to one or two things in connection with it before the medical men discuss it.

Six years ago when it became necessary to prepare our biennial report, this difficulty as to classification existed at the different hospitals. The question was what should be done. Finally this Board referred the matter to the hospital superintendents. There were then three of them, Drs. Gillman, Hoyt and Hill. Dr. Hill, I believe, insisted on the Kraeplin classification; Dr. Hoyt wouldn't agree to it. He said that the committee Dr. Witte referred to in his paper would report something, and he didn't want to spread upon the record anybody's classification. About that time, Dr. Witte came upon the scene, and finally these gentlemen referred this matter to Dr. Witte, and he proved to be a great compromiser; anyhow, he evolved the classification found in our reports. Now, Dr. Witte, after these years of deliberation, has come to the conclusion that the Kraeplin classification is the best extant. I suppose it is for these hospital gentlemen to settle the matter now, so that the new statistics can be based upon that classification.

Dr. Voldeng: I would like to know if it is the intention, if the classification is now adopted, if that will go into effect, so far as our coming biennial report is concerned. I think it will necessitate a great deal of work already done to be done over, although I think it can be done. Or is this classification, if adopted here to simply go into effect at the beginning of the next biennial period, and the classification now in vogue is to constitute the classification for the biennial report?

Superintendent Witte: I think it is feasible. It will necessitate a complete revision of what we now have, and would mean considerable labor.

Judge Kinne: Would it not be better to let it go into effect the first of July, and let the old report be based upon the present classification?

Superintendent Witte: I think it would be.

Superintendent Applegate: I appreciated this paper. I want to ask Superintendent Witte one question; in his research work, looking over the classification given by different writers in Europe, whether he finds they have taken kindly to our term "paranoia" in the classification of the insane?

Referring to the classification of our biennial report, as Superintendent Witte has said, it would necessitate considerable work. I find most of the diagnosis already made and entered in our record in our institution, as well as in the record here, and while I am very much in favor of the Kraeplin classification, I would suggest, and prefer that it begin July 1st, and our assistant physicians be given that classification, so that they can make their diagnosis accordingly.

Superintendent Witte: Answering Superintendent Applegate's question, I would say that the writers in this field in Europe accept such a well established type as paranoia. I myself can scercely see why they should not. It used to be formerly known as delusional insanity. You also see it referred to in older works as Monomania.

I may say, since writing the paper, I have had occasion to pick up a French journal, and I notice the Kraeplin system, with some modification is finding support there. I think that France is probably one of the foremost workers in our field. The progressive workers there are accepting it. I myself think it could with benefit be modified very materially, and yet we would not be in agreement with other classifications. So far as accepting this classification in the future, I think it would be most convenient to have it operative from, say, beginning the 1st of July, as suggested.

As stated in the paper, the classification is not final, but it more nearly represents what we actually observe; it is based upon the natural history of the disease, from its inception, its course, danger and extermination; whereas, the old classifications were based upon symptoms alone.

Superintendent Crumbacker: I was very much pleased with the paper. I agree with Superintendent Witte, that the Kraeplin system of classification, while by no means perfect, is the best classification that has yet been evolved, and I think everywhere, there is a tendency now on the part of authorities and authors to unite along the lines laid down by Kraeplin. In France, the alienists were somewhat slow to adopt this classificaton, and yet at the last meeting of the Psychological Association, Dr. Deneen, one of the leading lights of Psychiatry boldly advocated Kraeplin's classification, and the Association in the discussions showed a general tendency to come around to and adopt, with some modification, Kraeplin's classification.

I personally would like to see this classification adopted as soon as we can get at it. I would be very glad if we could adopt the classification in getting out our biennial report. Of course, if that involves extra work at the other hospitals, I do not wish to champion that action. I know that it is true, if we study the Kraeplin classification, Superintendent Witte would make some changes; and so would Superintendents Applegate and Voldeng. For that reason, in order to make our reports uniform throughout the United States and Canada, it would perhaps be better to adopt this classification of Kraeplin as laid down by him.

Superintendent Voldeng: I have no objection to adopting the classification of Kraeplin, even for the coming biennial report. While I have said it would entail some additional work, yet, I presume it is true in all the hospitals, that before the work is done on the statistical report, that the entire classification as it has been carried on within the two years will have to be gone over, even with our own classification. I know it is true with us, and perhaps with other institutions, that mistakes in diagnosis have been made that must be changed, or should be changed, at least, before the tables are prepared for the report, and I have no objection whatever to doing that additional work, and have Kraeplin's classification go into this coming report.

Superintendent Witte: I did not take the pains to read the classification as I took it and translated it from Kraeplin's last work. Kraeplin has the unfortunate habit of changing a little from edition to edition. It may be well enough to have these other gentlemen look to see what I have translated.

Superintendent Rothert: I move you, Mr. Chairman, that the four Superintendents be given power to act in respect to this matter of classification, as presented in the paper, and that it be referred to them to act within 30 days and report to this Board for its approval. Carried.

After consultation the Hospital Superintendents adopted the classification as recommended by Superintendent Witte and provided it should go into effect at once and be used in the following biennial report.

Superintendent Drake: Mr. Chairman, I move you that a vote of thanks be tendered Superintendent Smead, who came to us from Ohio and presented this most excellent paper from an educational standpoint.

By a unanimous rising vote, the motion prevailed.

Superintendent Smead: Allow me to move myself a vote of thanks to you, gentlemen, for your appreciation and kind courtesies to me, and I would say, the vote is unanimous.

The Committee on Program reported as follows:

PROGRAM FOR JUNE MEETING.

"Libraries in State Institutions," by Johnson Brigham, State Librarian.

"Insanity Not a Question of Conduct," by Dr. J. W. Wherry, Assistant Physician, State Hospital, Clarinda.

"The Defective Wards of the State," by Ophelia L. Amigh, Superintendent of State Training School for Girls, Geneva, Illinois.

"Our Industrial Schools," by Hon. John Cownie, Member of the State Board of Control.

"The Treatment of Tuberculosis in Our State Hospitals," by Dr. W. P. Crumbacker, Superintendent, State Hospital, Independence.

"Children Home Societies," by Clare Lunbeck, State Agent.

Value of Farm, Garden and Manufactured Products at the several Institutions for the First Year of Biennial Period, July 1, 1903, to July 1, 1904.

Institutions.	Shop.	Farm.	Total.
Anamosa	$ 4,246.26	$ 2,562.69	$ 6,808.95
Cherokee	3,637.00	16,475.23	20,112.23
Clarinda	8,077.67	20,595.21	28,672.88
Council Bluffs	1,666.54	4,457.35	6,123.89
Davenport	2,368.80	8,748.21	11,117.01
Eldora	4,333.02	15,440.26	19,773.28
Fort Madison	4,841.19	1,845.83	6,687.02
Glenwood	8,419.38	13,142.89	21,562.27
Independence	7,268.88	16,660.19	23,929.07
Marshalltown	1,318.08	4,655.03	5,973.11
Mitchellville	1,318.55	3,507.70	4,826.25
Mt. Pleasant	2,473.71	21,504.15	23,977.86
Vinton	912.49	2,360.07	3,272.56
Totals	$50,881.57	$131,954.81	$182,836.38

CLASSIFICATION OF FARM AND GARDEN PRODUCTS.

To remedy the conditions now existing with reference to the accounting for farm and garden products this Board has after due consideration and conference with our chief accountant provided that all farm and garden products commencing with the beginning of the new biennial period, viz: July 1, 1905, shall be accounted for by farmers, gardeners and storekeepers at every institution as indicated below:

Article.	Classification.
Apples	Bu.
Asparagus	Lbs.
Beans (dried)	Lbs.
Beans (green)	Lbs.
Beets	Bu.
Beef	Lbs.
Boar pigs	Lbs.
Blackberries	Qts.
Broom Corn	Lbs.
Cabbage	Lbs.
Carrot	Lbs.
Calves	Lbs.
Cantaloupes	No.
Cauliflower	Lbs.
Celery	Lbs.
Cherries (green)	Qts.
Chickens	Lbs.
Cider	Gals.
Corn	Bu.
Corn (pop)	Bu.
Corn (green)	Lbs.
Cows	No.
Cucumbers	Lbs.
Currants	Qts.
Dewberries	Qts.
Eggs	Doz.
Egg Plant	Lbs.
Fodder Corn	Tons
Gooseberries	Qts.
Grapes	Lbs.
Greens	Lbs.
Hay	Tons
Horseradish	Lbs.
Hides	Lbs.
Hogs	No.
Kohl-rabies	Lbs.
Kraut	Gals.
Lard	Lbs.
Lettuce	Lbs.
Mangel-wurzels	Lbs.
Muskmelons	No.
Milk	Lbs.
Millet	Tons.
Oats	Bu.

n in Iowa.

	I		Salaries and Other Expenses.	Total Expenditures.	Money on Hand at End of Year.
1	American tion,	....	$ 7,668.94	$ 7,668.94	$ 81.95
2	Benedict Des	....	3,994.95	3,994.95	363.44
3	Boys' an Siou	....	3,310.09	3,310.09	1,062.28
4	Children' Tab	....	231.92	231.92	34.23
5	Christian Cou	....	40,920.73	42,176.29	1,062.55
6	Des Moi Chil	.20	3,835.58	4,610.78	443.35
7	Dubuque Dub	....	1,396.93	1,396.93	148.52
8	"Elim" D Ho	....	1,490.39	1,490.39	575.16
9	Florence Siou	....	3,282.68	3,682.68	695.34
10	German Kin	....	2,706.81	2,706.81	269.05
11	German Old	....	3,343.73	3,443.73	326.38
12	Home fo Ced	.00	3,119.25	3,738.25	528.16
13	Iowa Chi Des	.00	19,472.78	20,600.78	384.61
14	Iowa Ev pha	....	7,254.40	7,269.40	1,290.27
15	Iowa Ho Dub	....	4,502.98	4,502.98	1,335.49
16	Iowa Od Hom	....	5,924.16	11,443.98	6,617.96
17	†Rescue Lee	....	....	....	....
18	St. Mary' lic Dav	....	9,878.42	9,878.42	259.93
19	St. Vinve Dav	....	3,879.78	3,879.79	714.00
20	Swedish Orph	....	4,109.11	9,310.56	....
21	United Chu	.45	8,496.92	12,890.45	283.36
		.65	$138,820.55	$158,228.11	$ 16,476.03

* Estimat

† This Ins red by Section 10 of Chapter 133 of the Acts of th filed.

Article.	Classification.
Onions (green)	Lbs.
Onions	Bu.
Oyster plants	Lbs.
Parsley	Lbs.
Parsnips	Lbs.
Peas (green)	Lbs.
Peaches	Bu.
Pears	Bu.
Pepper	Lbs.
Pickles	Gals.
Pigeons	No.
Plums	Bu.
Pork	Lbs.
Potatoes	Bu.
Potatoes (sweet)	Lbs.
Pumpkins	No.
Radishes	Lbs.

Article	Classification.
Raspberries	Qts.
Rhubarb	Lbs.
Rye	Bu.
Salsify	Lbs.
Sage	Lbs.
Sheep	No.
Sorghum	Gal.
Spinach	Lbs.
Straw	Tons.
Strawberries	Qts.
Squashes (summer)	No.
Squashes (winter)	No.
Tomatoes	Bu.
Timothy Seed	Lbs.
Turnips	Bu.
Veal	Lbs.
Watermelons	No.

Broom corn is to be weighed after it is seeded and cabbage is to be weighed after the roots are removed, and in case it is necessary to leave the roots on in order to hang the cabbage up or to bury it, a careful estimate should be made of the weight of the heads excluding the roots.

EDITORIAL NOTES.

Des Moines, Iowa, June 1, 1905.

Compulsory education of blind children is urged by Superintendent Holmes of the Michigan School for the Blind in his report for 1903-4.

The First Biennial Report of the North Dakota Institution for Feeble-Minded Children at Grafton, N. D., is at hand. The institution has a capacity for 125 inmates and opened with 81.

The Superintendent of the Morris Plains, N. J., State Hospital urges in his Twenty-ninth Annual Report that two cottages be erected for tuberculous patients. He also calls attention to the fact that children of five years of age are being committed to the hospital and recommends the passage of an act fixing an age at which persons may be admitted. He also favors a law providing for the admission to the hospital of "indigent, habitual drunkards who are dangerous to their neighbors and their families, who disturb the peace of their homes and who by virtue of their vicious natures beget children of a like sort."

The inspectors of the Eastern Pennsylvania Penitentiary have cut off visitors' passes into the prison.

Rev. G. L. Smead, Superintendent of the Ohio State School for the Blind, read a valuable paper at the last conference which appears in this issue. His presence and paper were greatly appreciated.

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Report of the Eighth Annual Meeting of the Nebraska State Conference of Charities and Correction.

Ninth Annual Report Medfield Insane Asylum, Massachusetts, 1903.

Second Biennial Report Board of Control of Minnesota, 1903-4.

Report of Institution for Imbeciles, Copenhagen, Denmark.

Ninth Annual Report, Springfield (Md.) State Hospital.

First Biennial Report Idaho Industrial School.

Fifty-sixth Annual Report N. Y. State Industrial School, Rochester.

Fourth Annual Report Board of Prison Commissioners of Massachusetts.

Thirty-fourth Annual Report Central (Va.) State Hospital, 1904.

Twenty-sixth Annual Report State Board of Charity, Massachusetts, 1904.

First Annual Report of the Henry Phipps Institute, 1903.

Firty-fifth Annual Report Matteawan (N. Y.) State Hospital.

Fifteenth Annual Report Board of State Charities of Indiana.

Seventh Annual Report of N. J. State Village for Epileptics, 1904.

Thirty-second Annual Report Central Kentucky Asylum for the Insane.

Biennial Report Minnesota School for Feeble-Minded, 1903-4.

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INSTITUTION NOTES.

The Board of Control made semi-annual visits as follows:

School for the Deaf, April 19th and 20th.

Institution for Feeble-Minded Children, April 21st and 22d.

Clarinda State Hospital, April 23d and 24th.

Mt. Pleasant State Hospital, April 25th and 26th.

Penitentiary at Ft. Madison, April 27th and 28th.

Contracts hace been let for the erection at the Institution for Feeble-Minded Children of a boiler and power house, stack, ice plant building and 1,600 feet of tunnel.

Contracts have also been let for the following buildings at the Iowa Soldiers' Orphans' Home, viz: a storehouse and cold storage building, a laundry, and for changing the present laundry into a general kitchen.

Contracts have also been let for the heating and plumbing of the farm cottages at the State Hospitals at Cherokee and Clarinda.

The new hospital at the School for the Deaf has been finished and equipped and is now occupied.

The operating room at the Soldiers' Home is now fully equipped.

Superintendents Witte, Applegate and Crumbacker attended the annual meeting of the American Psycho-Medical Association at San Antonia, Texas; Superintendent Witte read a paper at the meeting.

Work has begun on the new prison wall at Fort Madison.